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VIEWS, NEWS AND INTERVIEWS.

The Philadelphia & Reading Railroad Company has loaned the Doylestown, Pa., Fire Company a big steel locomotive tire to be used as a fire alarm. It will be fitted up with an electric striker.

Woodite has proved very successful as an insulator for high-tension currents. During the three years in which it has been used for this purpose at the Deptford station of the London Electric Supply Corporation, there has not been a single breakdown or failure, says a London exchange. Before trying this material, there has been great difficulty in insulating the pole-pieces of the field magnets of the large dynamo. A tension of 40,000 volts has proved unequal to piercing woodite sheets one-eighth inch thick. The material has also the advantage of being unacted on by oil, even at high temperatures.

Frank Dunbunster, the postmaster of Little Oak, L. I., is fond of experimenting with electricity, and his office is regarded as a model of its kind. His latest improvement is an arrangement by means of which a bell rings in the store or house of any one in the village who has a private letter box whenever a letter or paper is placed in it, and the cost is but $1 a year extra. He also makes the round of the principal streets each afternoon selling postal cards and stamps from his wagon. It is a labor of love with him, as the salary of the office is only $38 per annum.

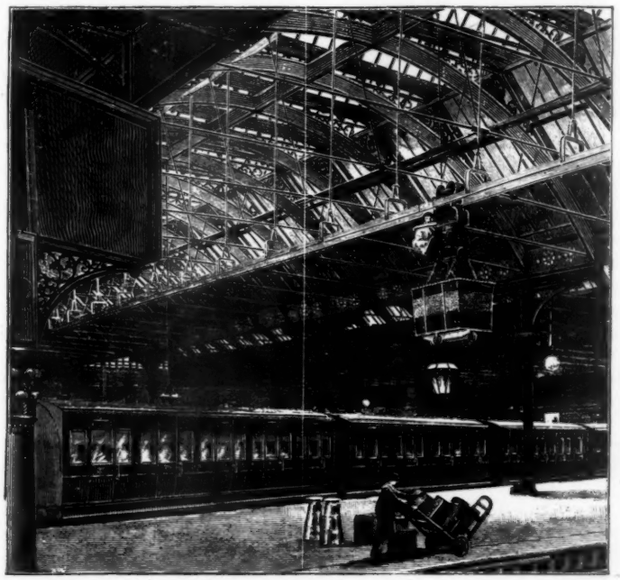
The motormen of an electric car line in Ohio have had a jar of lemonade on hand in the terminal barn ever since the hot weather began. Each employé would contribute his nickel a day, and the cooling drink was kept in a five-gallon jar within the barn. It was not long before the location of the jar became generally known, and the daily brew soon proved entirely inadequate to supply the frequent demands of visitors. How to restrict the privileges of the lemonade jar to the authorized few without directly giving offense was the problem which presented itself. The electrician of the company came to the rescue. The nail, chain, mug and jar were connected with the lamp circuit, and the mat in front of the jar was dampened. The next thirsty visitor that came seized hold of the mug and received such a shock as to force him to throw it down. Taking fresh courage he grasped it again and dashed it into the liquid, completing the circuit and evoking another shock, which jerked the cup roughly and spilled its contents.

The report of the principal electric railway company of Berlin, Germany, shows that in 1893 there was only one personal accident on its lines per 41,625 car miles run. Other German cities make an equally satisfactory showing, and in Halle there was in 1893 only one person injured upon a running of 88,640 car miles.

According to Charles Booth, in his latest work on the "Life and Labor of the People of London," the great majority of men employed in all branches of electrical work in London are under 25 years of age. It is also stated that of some 5,000 men engaged in different electric works, only 13 per cent are members of a trade union.

An Electric Traveling Crane for Carrying Baggage.

The illustration on this page shows an ingenious form of traveling crane, recently erected at the Victoria Station, Manchester, England, by Mr. J. A. F. Aspinall, the chief mechanical engineer of the Lancashire & Yorkshire Railway. The apparatus is intended to facilitate the movement of passengers' baggage, and has been very successful in relieving the congestion of traffic on the platforms. As will be seen from the engraving, which is from London *Engineering*, a tramway has been suspended from the roof of the station, and on this runs a light car, fitted with an electric motor and a seat for an attendant. Chains passing over a winch barrel, also operated by electricity, permit the basket truck, shown in the engraving, to be raised or lowered, and in this way it is possible to transfer a load of parcels from one platform to another, over the heads of the passengers, who are thus free from the usual inconveniences to which they are subjected by the movement of the baggage at large stations. The motor was designed and built at the Horwich Works of the company, and it is proposed to extend the system to other stations. Perhaps the most surprising feature of the device is that nobody seems to have thought of it before. The plan should, if anything, be considerably cheaper than the elevators and subways now often provided for transferring baggage across the tracks.



An Electric Traveling Crane for Carrying Baggage.

Cotton States and International Exposition.

Exhibitors are already at work in the Electrical Building at the Cotton States and International Exposition at Atlanta, Ga. The American Bell Telephone Company has a force of men preparing their exhibit. This company will occupy over 1,000 square feet and their display will be very fine. It will comprise a complete central station, operating telephones in all parts of the grounds, connected with the main system in Atlanta, and with the long-distance system throughout the State. Their space will be fitted up in a very handsome manner and at heavy expense, and everything will be shown that illustrates the growth and progress of the telephone business. The General Electric Company's display will be most elaborate. Their space also will occupy considerably over 1,000 square feet and the design of their exhibit will be original and unique. The Westinghouse Electric and Manufacturing Company have also secured one of the large central spaces and will fill it with a varied and interesting exhibit. The Brush Electric Company and Fort Wayne Electric Corporation were also among the first to take a large amount of space, and they will not be behind any other company in the size and beauty of their exhibits.

THE BALTIMORE BELT LINE TUNNEL.

DESCRIPTION OF THE OVERHEAD CONDUCTORS AND THE LINE CONSTRUCTION.

Continuing from last week's issue the description of the electrical plant used in connection with the Baltimore belt line tunnel, the ELECTRICAL REVIEW presents herewith illustrations and data of the overhead conductors and the line construction.

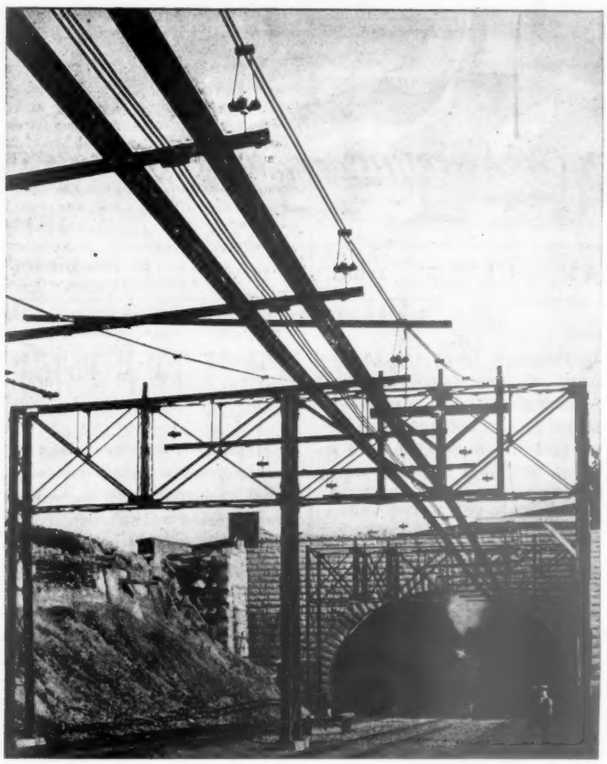


FIG. 1.—OVERHEAD CONSTRUCTION AT ENTRANCE TO BALTIMORE BELT LINE TUNNEL.

The conductor is simply a reversed iron conduit or trough erected overhead on trusses in the open and in the tunnel attached to the crown of the arch. In the open the conductor is directly over the center of the track; in the tunnel over the center line of the space between the tracks. It extends from Henrietta street on the south to Huntington avenue on the north, a distance of 15,000 feet.

The conductor consists of two 3-inch iron Z bars three-eighths of an inch thick, riveted to a cover plate one-quarter of an inch thick and 11½ inches wide, and is constructed in sections 30 feet long. It weighs about 30 pounds per foot. At intervals of 15 feet inside the tunnel there are suspended from the arch transverse frames, consisting of two 3-inch channels, held together by plates four inches wide, and holding four castings, into which are fitted conical porcelain insulators. In the masonry of the tunnel are fitted the bolts necessary to support these frames. They are two feet six inches long, have split ends, and extend 12 inches into the masonry. The bolts pass downward through the outside pair of insulators. The bolts attaching the conductors to the channel frames pass through the inside pair of insulators and support an iron stirrup in which the conductor hangs. This method affords a double insulation, and if leakage occur it can only be by the current passing the insulators between the conductor and the transverse channel, and then the insulation between the channel and the bolt in the tunnel arch. There may be a defective insulator either on the roof bolt or on the bolt which supports the conductor, but only when two insulators on the same transverse channel frame are defective will leakage occur. The height of the conductors above the level of the top of the rails is 17 feet six inches in the tunnel, and they are fixed a little on each side of the center line. This plan was adopted to avoid the risk of the conductors striking brakemen who might be standing on the top of passing freight cars. An additional precaution is provided in the shape of continuous wooden shields fastened to the iron stirrup which supports the conductors.

Outside the tunnel the height of the conductors above the rails is increased to 22 feet. The supporting structure in the open consists of longitudinal catenaries of two chains of iron rods, having a span of 150 feet, suspended from transverse trusses, supported by columns of latticed steel channels erected on either side of the double track. The catenaries pass over the top cord of the transverse trusses and are fastened to a yellow pine timber post, acting as an insulation set therein. From the joints in the catenaries vertical rods are dropped at intervals of 15 feet to support the electrical conductors. The vertical rods are attached to a casting holding a porcelain insulator, and through this a short bolt passes up to the joint in the catenary. The double insulation is secured by this vitrified porcelain insulator and the timber post passing vertically through the transverse girder. A hood of galvanized iron is fixed to the top of the timber post. At the ends of the line an anchor pier receives the ends of the conductors. The trusses vary in length from 30 feet to 62 feet, the latter being required to span five tracks. All the iron work was made by the Maryland Steel Company.

Upon the straight track the conductors are suspended from single catenaries, while upon the curves a double catenary is employed, and the conical insulator is inverted and supported in a casting bolted to the two vertical rods which drop from the catenaries. The vertical rods support a channel frame to which are bolted the conductors and the feeder cleats or clamps. Each joint of the conductor is bonded with a bond of two No. 0000 wires.

The feeder cables are of bare stranded copper of 61 strands, each of 1,000,000 circular mils cross section. These are supported in iron cleats fastened to channel frames riveted to the overhead conductors at points near to the heavier channels to which the conductors are suspended.

The lead covered primaries for the tunnel lighting plant are carried on posts, set on the side of the cut, to the southern portal, where they drop to the tunnel and are carried upon porcelain knobs fastened to wooden blocks bolted to the masonry. At the points of support the cables are armored with wire to prevent abrasion. The secondaries are carried in cleats, also fastened to wooden blocks, similarly attached, and placed on either side of the tunnel about eight feet from the ground and 15 feet apart. They are, however, staggered, and thus occur alternately at every seven and a half feet throughout the tunnel. Each block carries a lamp at its lower end and is there cut out so that the lamp socket may be protected from moisture and dripping water from the tunnel walls. The lamps used are 32 candle-power, 52-volt Edison standard incandescent lamps.

FIG. 2.—OVERHEAD CONSTRUCTION AT POWER STATION.

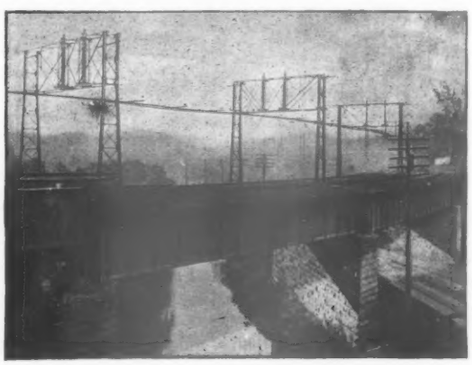


FIG. 3.—OVERHEAD CONSTRUCTION ON VIADUCT.

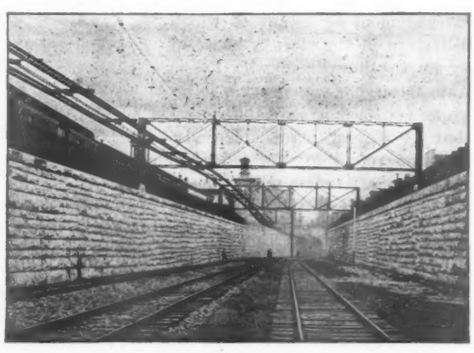


FIG. 4.—LINE CONSTRUCTION IN CUT.

OBITUARY.

Arthur H. Lowerre, well known in business circles and a former president of the Atlantic Avenue Railroad Company, died at his home in Brooklyn, N. Y., on July 6. He was 82 years old and of an old Huguenot family.

Joseph Barker Stearns, inventor of the duplex system of telegraphy, died at Camden, Me., on July 4. He was born at Weld, Me., on February 28, 1831, learned telegraphy and in 1855 became superintendent of Boston's fire alarm telegraph system. His patents on the duplex system were purchased by the Western Union Telegraph Company and the cable companies.

SETTING TYPE BY SOUND.

AN INTERESTING EXPERIMENT WITH THE TELEGRAPH AND THE LINOTYPE.

An interesting experiment that tends to fill a long-felt want was made recently in Louisville, Ky., by Mr. Boyle G. Boyle, managing editor of the Louisville *Post*, and Mr. Richard Cogan, chief operator of the Western Associated Press at that point, in which these gentlemen fully demonstrated the feasibility of taking telegraphic dispatches directly from the wire to a typesetting machine. The experiment has been carried on quietly for some weeks, and no publication was made until the persons interested felt that they had demonstrated that they were not on a wild goose chase and that what they had set out to do could be done.

The result of these experiments is that they are now confident that the telegraph press reports can be taken from the wire and put into type by the receiving operator with great ease, speed and satisfaction.

Recently a loop of the Associated Press was run into the composing room of the *Evening Post* at Louisville. A giant telegraph sounder, placed within a resonator, was located at the height of the receiving operator's ear and close enough to him to avoid the slight noise of the machinery. Then Mr. Cogan selected a number of dispatches from the Associated Press report and sent them over the wire to Mr. Boyle, who copied them on the linotype.

At first a speed of only 15 words per minute was attempted, but it was at once apparent that the keyboard of the linotype was much swifter than this and that a much higher rate of speed could be maintained. The sending operator was accordingly given instructions to "rush" it, and soon a maximum speed of 50 words per minute was attained and kept up. The matter was sent in abbreviated form ("cut," as the operators say), so that the receiver on the linotype spelled it out in full and kept up with the sending operator.

The speed of the fastest telegraphers is seldom more than 50 words per minute, averaged on several hours' work; the speed of the fastest linotype operators is often 7,500 ems; an average speed for the telegraph is 25 words per minute, allowing for stoppages; the average for the linotype is 4,500 ems per hour. So that it can be readily seen that the relative speed of the two are about the same, and with proper practice any intelligent telegraph operator should be able to "take" a report on the linotype. The keyboard and its attachments on the linotype are swifter than the typewriter, and it is thought that by introducing this machine directly to the receiving operator that the intermediate services of the typewriter can be dispensed with, and the "telegraph matter" given to the newspaper editors in the form of "proof" instead of "copy."

It is hoped that the introduction of the typesetting machine will be undertaken by some of the greater papers and a thorough test of the matter be made.

As an instance of its great benefit, it is suggested that the Washington matter for the great dailies, which comes over a single wire especially prepared for our metropolitan papers, could be readily handled in this manner, and that, as the matter is all specially prepared and needs but little editing, that it would be a relief to the editors to get it in the form of a proof.

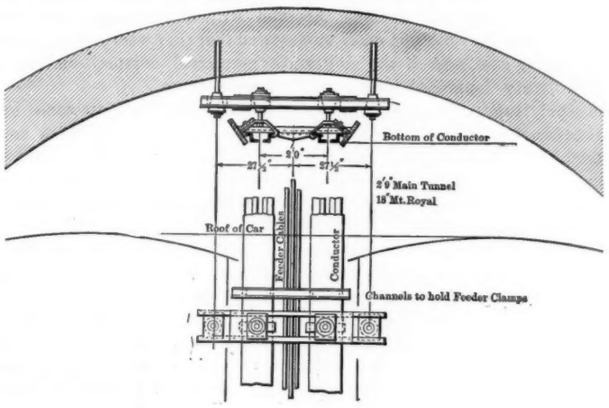


FIG. 5.—SECTION THROUGH TOP OF BALTIMORE BELT LINE TUNNEL.

The Louisville gentlemen who have been experimenting on this matter express the opinion that its practicability has been fully demonstrated; its adaptability is yet to be proven. They entertain no doubts of their ability to "receive" any report from any wire directly on the typesetting machine, and can set it in type as fast as it can be sent over the wire, or as fast as the typewriter operators now take it from the wire.

The Boston *Standard* claims for G. W. Greene, a compositor on the paper, the championship record for type-setting on the Mergenthaler machine, stating that on June 28 Mr. Greene set 13,850 ems solid agate in one hour, making but 29 typographical errors. This speed is said to be double that of any telegraph operator in the United States.

Dr. J. A. Fleming's Tests of Okonite Cable.

The following extracts are from the reports of two tests of okonite cable made by Dr. J. A. Fleming, the well-known electrical author and professor of electrical engineering in University College, London. The reports were made to Laing, Wharton & Down, of London. The first test was made in December, 1894, and the second in February, 1895.

First test.—The cables sent to me were in large coils of about half mile lengths, and came just as they were forwarded by the makers. * * * I have found in this okonite cable a very marked increase of insulation resistance with time of charging, and have therefore given all the results in the form of curves on a chart appended to this report, in which the insulation resistance of the samples is shown in megohms per mile of cable after one to five minutes' charging. * * * My opinion of these cables is, therefore, that the okonite material is a remarkably good insulator, and that the samples of okonite cable submitted to me represent a very high degree of excellence in the manufacture of insulated cable. I do not lay much stress on mere megohms per mile in a cable. The real practical test of a cable is the electrical pressure it will withstand after prolonged soaking in water, and such general rough usage as the cable will experience in actual handling. In order to test the mechanical toughness of the okonite material, I bent and kinked several samples at such sharp angles as to break the copper strand inside the okonite insulation. This mechanical toughness, combined with its flexibility, is a great point in its favor. I consider that this okonite cable is a very excellent and high-class cable for all outdoor, overhead, or underground electrical work, with high electric pressures, whether alternating or continuous. I regard it also as an excellent material for indoor wiring work, in cases in which the conductors are necessarily exposed to moisture, and under conditions in which a very large factor of safety must be employed. The standard copper conductor being tinned and twisted was not in a form suitable for a very accurate test of the copper conductivity, but the figures given for the resistance per mile of the coils A, B and C show that the copper employed is not less than 98 per cent copper conductivity in all probability.

I consider that the behavior of these samples of okonite cables places it in the front rank as a class of cable for electric lighting and transmission work.

Second test.—The next question to which I have directed my attention is the power of the okonite material to withstand the action of chemical agents. For this purpose fair samples of the okonite cables were put to soak on January 12, 1895, in the following chemical solutions:

A was put into strong salt and water.
B was put into Paraffine oil.
C was put into linseed oil.
D was put into caustic soda solution.
E was put into dilute sulphuric acid, 1 : 10 or battery acid.

These samples were left soaking in these solutions until February 15, or for 34 days. They were then tested for insulation at 100 volts and found to be in excellent condition. The samples were then submitted to the electric pressures test, the pressure being taken up to 3,300 volts by the use of an alternating current having a mean pressure of 2,400 volts, and all of these showed no signs of failure when exposed to this pressure for five minutes. This forms an exceedingly severe test of the high insulating quality of okonite. That after this soaking in oils, brine, acids and alkali for more than a month all the samples withstood 2,400 alternating pressure perfectly. I have no hesitation, therefore, in saying that I think the okonite insulation is a remarkably fine insulating material and one which, by its electrical and mechanical qualities, is well fitted for use in electric cables for high or low pressures. I have not found that the severe cold of the last month has rendered it at all brittle.

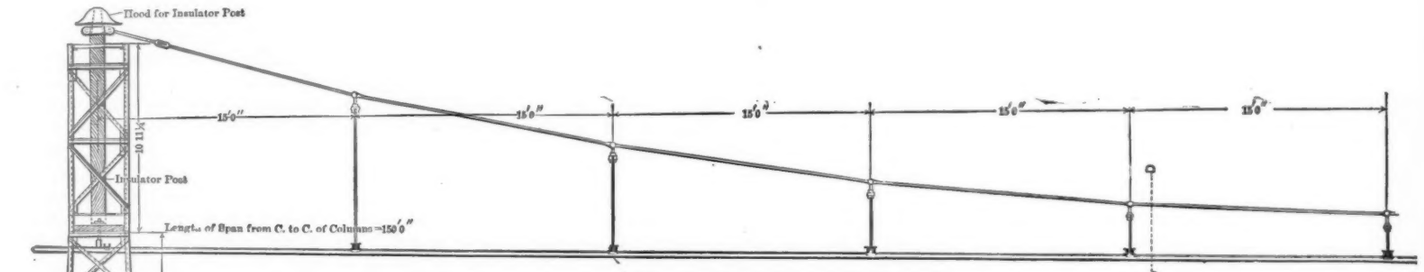


FIG. 6.—ELEVATION OF SPAN OF TANGENT.

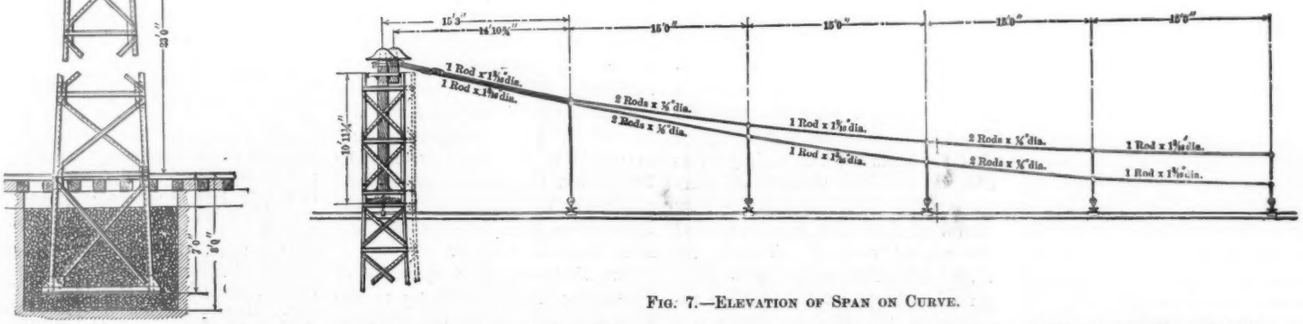


FIG. 7.—ELEVATION OF SPAN ON CURVE.

The Parliamentary Telephone Enquiry in England.

In an article in our issue of April 17 we gave some account of the telephone situation in England and of the debate in the House of Commons which resulted in the appointment of a Select Committee "to consider and report whether the provision now made for the telephone service in local areas be adequate and whether it is expedient to supplement or improve that provision by the granting of licenses to local authorities or otherwise." In accordance with the promise made in that article we have now to make a *resumé* of the evidence given before the committee.

It is not a particularly easy task to summarize such extended proceedings in any reasonable space. The committee has held some 16 sittings of about four hours each and has heard a large number of witnesses. Even the abstract reports of the hearings fill many columns of the technical journals, and when the report of the committee with the complete transcript of the evidence is published as a British Blue-book, it will be a larger work than any existing treatise on telephony.

However, a large proportion of the evidence was absolutely waste of breath and time, as it was the mere expression of individual views and opinions. Another large portion of the evidence was of a purely historical nature, given for the purpose of informing the committee on the development of the actual situation, and still another was popularized—very much popularized—expert evidence to post the committee on the general subject of telephony. Therefore, a goodly percentage of the matter brought before the committee may be dismissed with scant reference. By far the most interesting and valuable of all the witnesses examined was the representative of the National Telephone Company, Mr. J. Staats Forbes, who made a very strong answer to the attacks on his company and gave an excellent *exposé* of its business operations.

A quite noticeable feature of the enquiry was the large number of witnesses of various kinds who had either grievances or fads to ventilate and the amazing lack of grasp of the subject they exhibited in the process of ventilation. In reading the evidence we have been frequently reminded of the views expressed by some of the supporters of the late lamented telephone bill at Albany. There were various kinds of aggrieved witnesses with various kinds of grievances. Several criticised the agreement between the Post Office and the National Telephone Company on the score that it did away with competition and practically left the National company with a monopoly of telephony as far as local exchanges were concerned. Other criticisms scored the scale of rates for long-distance connections instituted by the Post Office, which results in charges higher for certain distances than those of the company. Several other points in the situation brought about by the famous agreement were the subject of complaint, but as far as possible the committee ruled out any evidence tending to bring about a discussion of the agreement, which was scrupulously considered as an established and unassailable undertaking.

The majority of the witnesses were aimed more or less at the real subject of the enquiry—the adequacy of the present service and the expediency of municipal competition. It must be confessed that they did not make out a very strong case, and if the ability of the County Councillors, and other municipal luminaries, to organize and conduct telephone systems be gauged by the showing they made of their preliminary study of the subject the committee will be amply justified in deciding against them. The general tenor of this class of evidence was to show that the actual service was poor, the actual charges unreasonably high and that the municipalities could provide service at much cheaper rates. Whether they could provide improved service, or even equal with the present, was, of course, a matter of the purest speculation.

Evidence to the first point was produced by putting forward the kicking subscriber, a familiar inhabitant of every country in the world except Turkey—where there are no telephones. Evidence to the second point did not get beyond haphazard and inaccurate citations of the rates in some of the Continental countries, the favorites being Norway, Sweden and Switzerland, where life is so simple and living so cheap that a man is passing rich on $500 a year. The evidence to the third point consisted of estimates prepared by engineers of the capital cost and working expenses of telephone systems constructed according to their own ideas—ideas which, so far as they have been published, are somewhat at variance with the preponderance of opinion of experienced telephone men and with established practice. According to these estimates, which were not discussed in detail, service could be furnished in Glasgow to 5,000 subscribers at a flat rate of £5 (the present rate being £10), and in London to 10,000 subscribers at a rate of £10 (the present rates ranging from £10 to £20 with mileage charges). That the estimates were unduly favorable to municipal views would seem obvious when it is said that the most liberal of those for London placed the capital cost of a system for 10,000 subscribers at £400,000 ($200 per subscriber), and the working expenses at £80,000 a year ($40 a year per subscriber).

Much of the evidence outlined above (the municipal gentlemen and their friends were so prolix and so irrelevant that even to extract their testimony would be waste of space) was materially weakened by cross-examination and by rebutting evidence. If the National Telephone Company had been represented by counsel as being really in the position of defendant, it very fairly might have been, not very much of the case made out by the friends of municipal telephones would have been left standing. But the only cross examination was by members of the committee, which contained several eminent lawyers who sifted much of the loose matter presented with fair success.

In rebuttal of the charges of poor service and inadequate facilities, several subscribers using the telephone on a large scale gave expression to their satisfaction with the service and with the charges, and further stated that they were strongly opposed to municipal competition in telephone matters.

Mr. Forbes dealt to some extent with the comparisons with foreign countries, showing that any such comparison was misleading, unless the difference in conditions were also set forth.

The general drift of the evidence given by those dissatisfied with the present state of affairs was in favor, failing competition by the municipalities or otherwise, of nationalization of the entire telephone system. This was urged because the example of other European countries was generally in that direction and because a strong belief existed that if the government took over the whole service it would be able to reduce the rates.

Mr. Preece, who was the principal expert witness, was decidedly against municipal competition and strongly in favor of the acquisition of the whole system by the government. His objections to municipal telephony were that the multiplicity of systems would lead to confusion in general communication, that the systems would generally be run at a loss, which would result in inefficient service and incurring the opposition of the majority of ratepayers, that the expert supervision and labor necessary to high efficiency could not be secured by municipalities working comparatively small isolated systems at cheap rates, and that such isolated systems would prevent uniformity of practice in the working of the trunk or long-distance system. Mr. Preece had not much faith, moreover, in the estimates prepared by engineers for the County Councils and by others not having practical experience in telephony. Mr. Lamb, one of the secretaries of the Post Office, was also an unbeliever in competition and in estimates for cheap systems; he hoped that the whole service would eventually be taken over by the Post Office, but did not believe that rates would be reduced.

Mr. Forbes gave a quantity of interesting figures relating to the rates and expenses of the National company, the extent of its system, the traffic and the efficiency of operating. He said that, in reply to a circular sent out by the company, 2,346 London subscribers stated their satisfaction with the present service and their non-approval of the County Council undertaking to furnish telephone service, 266 sent qualified replies, 43 were in favor of the Council and 36 refused to sign. Tracing the history of the company through the various amalgamations, he showed that in 1889 the companies that combined to form the National had 23,836 subscribers. In April, 1890, they had increased to 27,706, and in April, 1895, to 75,216, with 86,032 stations; of the increase of 47,510 subscribers in five years, 12,078 were from companies absorbed and 35,432 clear gain of new subscribers, an average of 7,086 new subscribers a year. April, 1895, the system stood as follows: Towns supplied, 537, exchanges, 593, subscribers' lines, 75,216, stations, 86,032, annual traffic, 139,639,032 (equal to an average of 6.18 calls per subscriber per working day).

The average rental paid is £9 2*s*.2*d*. (equal to about $45) and the average cost to the subscriber per connection 1.16*d*. (2.32 cents), making the average cost of the service per subscriber per working day 7.16*d*. (14.32 cents). The operating expenses average £6 4*s*. 7*d*. ($31) per line. Analyzing these figures, Mr. Forbes showed that of the average operating expenses £2 16*s*. 3*d*. ($14) per line went for wayleaves, rates and taxes, royalty and other charges that the State Continental systems were free from. Comparisons such as these rob the quotations of cheaper foreign rates of much of their weight.

By way of showing that the company is improving its plant, Mr. Forbes said that nearly 19,000 subscribers, or one-fourth of the total, were provided, or in course of providing, with metallic circuits. In proof that complaints of the service had been overstated, a statement was put in of the average complaints per subscriber in 1894 at a large number of places; the average complaints per line for the whole kingdom were 73, the figures ranging from 3.79 in Glasgow to *nil* in several places, the large majority being below one. The average traffic was 1,800, so that one connection in 2,400 gave rise to a formal complaint. As each connection implicates two subscribers and potential complainants, this did not indicate widespread dissatisfaction.

Bearing on the rapidity of service and operating efficiency, Mr. Forbes presented figures for a day's work of three Scotch exchange systems, Glasgow, Aberdeen and Edinburgh, from which it appeared that in Glasgow 88 per cent of the total day's connections were completed in less than 30 seconds, in Aberdeen 93 per cent and in Edinburgh 62 per cent. This is a very good showing for Glasgow and Aberdeen, but we are a little bit curious to know by what method Mr. Forbes times the operating of every one of the connections, numbering 34,513, made by an exchange in one day. He also gave an analysis of the day's work of one operator's position in a London exchange, from which it appears that of a total of 254 connections, 34.6 per cent were completed within 30 seconds, 28.7 per cent within one minute, 22.8 per cent within one and a half minutes, four per cent within two minutes and 10 per cent taking over two minutes. This is scarcely such a brilliant showing for a not overworked position.

The last meeting of the committee for receiving evidence was held May 28, and the committee is now engaged in preparing its report.

LOCATION OF GROUNDS IN ARMATURES, FIELDS, ETC.

READ BEFORE THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, NIAGARA FALLS, N. Y., JUNE 25, 1895, BY CLARENCE E. GIFFORD.

This paper presents no novel scientific principles. The methods herein described are but simple adaptations of the principle of the Wheatstone bridge. They have been in use by the writer for several years, and he, having devised them for his own use, and found them very rapid, accurate and simple, is led to believe that they may be of considerable service to others. A slightly similar, but evidently less perfect, method was published by Mr. Bronsson in the London *Electrical Review*. The insufficiency of Mr. Bronsson's method in cases where two grounds at some distance apart exist, is admitted. The methods herein described deal successfully with such cases.

If the work can be performed in a very quiet room, two or three cells of battery, a telephone receiver and connecting wires comprise the necessary apparatus. In some cases two "table binding posts" and a foot or two of No. 18 or No. 20 bright iron wire will be a convenient addition. Where noise will not permit the use of a telephone, a dead-beat reflecting galvanometer, a milli-voltmeter, or some other form of delicate and rapid working visual indicator must be used instead. If an armature is to be tested without removing it from the machine, connection with the battery may be made through the brushes, first making certain that the short-circuiting switch is opened, if dealing with an arc machine. The points of connection with the battery need not be diametrically opposite, and may be made by the wires being firmly pressed against the commutator by an assistant, if more convenient.

Good electrical contact between metallic surfaces can better be secured by cleaning the same thoroughly with kerosene, which removes foreign matter and is so fluid that it will in no way interfere with perfect contact, when moderate pressure is applied. Especially when making measurement of resistance of armature sections, it is even advisable to have the surface of the commutator quite wet with kerosene during the operation, as this avoids trouble from grease or dirt which might get on the surface from handling, subsequent to cleaning, and it also prevents the contact points becoming oxidized by any sparks which may occur at the moment of breaking contact. True, the oil is an insulator, but we use it in this case as a detergent simply.

Returning to the armature, connection being made between battery and commutator, first determine whether the armature circuit is complete throughout. If the circuit is complete, a click will be heard in the telephone when the two terminals of the same are brought in contact with any two contiguous bars of the commutator, or when contact is broken. If an open circuit exists on either side of the circuit, of course no sound will be heard in the telephone when used on that side, except when connection is made or broken by it between the bars lying on opposite sides of the break. (See Fig. 1.)

Close any open circuit temporarily by bridging between the two bars with a drop of solder. Two or more breaks can evidently be located by suitably shifting the battery contacts and searching as before. Open circuits will, of course, when an armature continues in work, soon cause burns between the bars that will indicate unmistakably their location. Having closed any open circuits, and the battery being connected to two points of the commutator, approximately opposite each other, one terminal of the telephone is connected to the armature shaft or frame of the machine, and the other terminal is drawn completely around over the surface of the commutator, while the telephone is held to the ear. If only one ground exists, two balancing points, or points giving the least noise in the telephone, will be found.

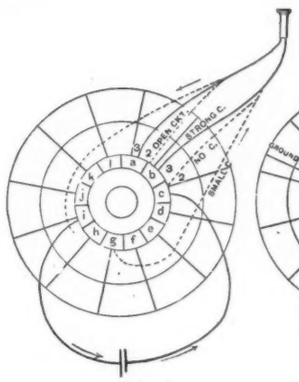


FIG. 1.

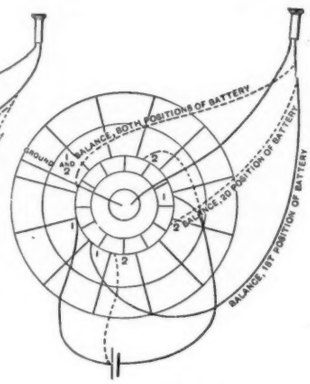


FIG. 2.

In an armature of ordinary construction, one of the points so found will be on the bar nearest the real ground, while the other balancing point bears what might be termed a "bridge relation" to the first, being at practically the same potential—the armature itself forming, in reality, a veritable Wheatstone bridge.

Now, shift the points of battery contact a few bars either way and the true ground, if but one exists, will be indicated in precisely the same position as before, while the other balancing point will shift every time the battery contacts are shifted. (See Fig. 2.)

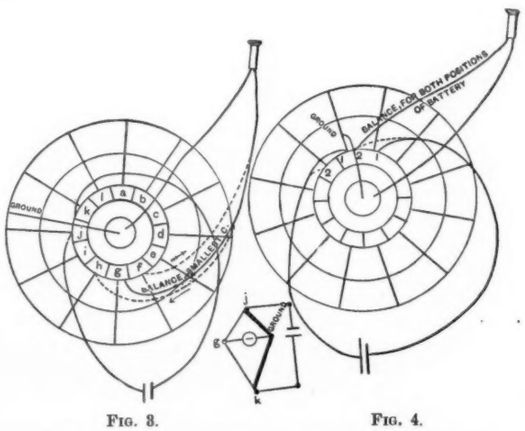


FIG. 3.

FIG. 4.

If two grounds exist, two balancing points will be found, as before, but both points will shift more or less when the battery contacts are shifted, provided the grounds lie on the opposite sides of the same battery contact. This case will be considered later.

In the case of one ground, having determined its location approximately, fix it as closely as may be by making and breaking contact with the telephone terminal on each of the more quiet bars separately, until by comparison, the two giving the faintest clicks are determined. If your hearing has served you correctly these two bars lie nearest the trouble, the fainter one being the nearer. Prove the non-existence of a second ground by placing one of the battery contacts on the first bar to the right of the apparently permanent balancing point just found, and then on the first bar to the left of said point, the other contact being nearly diametrically opposite. This balancing point should still remain unchanged if no other ground exists.

The next step is to connect the battery to these two bars just fixed upon as lying nearest the trouble. The armature still forms a "bridge," the portion included between the two contiguous bars to which the battery is now connected forming the one side, and the remainder of the armature, the other side. (See Fig. 3.)

One of the telephone terminals is now connected to the shaft as before, and the other terminal again drawn around the commutator. If the balancing point is found, say one-sixth to one-half, the long way around from one battery contact to the other (these contacts being on two contiguous bars), the trouble lies in the coil between those two bars, and the point of trouble divides the coil in the same ratio as the balancing point divides the remainder of the armature, the ground and the balancing point being respectively nearest the same battery contact. If the balancing point falls on the same bar as one of the battery contacts, the ground is located on that bar or on the lead between it and the armature, provided the balancing point is found to be upon the same bar when the battery contacts are both shifted one bar to the right or left of their original position. (See Fig. 4.)

If the balancing point appears to be found within three or four bars from one of the contacts, the precaution should be taken to test its correctness by moving both battery contacts one bar toward the balancing point. If the trouble was between the battery contacts when in their previous position, this shifting of the contacts will now throw the balancing point clear around onto the contact which was, in the previous position, farthest away from the balancing point. If, on the contrary, the balancing point remains unmoved by this shifting of the battery contacts, it shows that this balancing point is the point nearest the real ground, and that the ear was deceived in its first supposed approximation, which, with due care, however, is not likely to occur.

If such error has been made, the new point, as indicated, together with first the bar on one side of it, and then on the other, must be tried as points of battery contact; or, much better, make a new start with the contacts nearly at opposite sides of the commutator and proceed as before. A single 20,000-ohm ground on a one-ohm armature should be located accurately in not over three minutes in a quiet room. Higher resistance grounds require more battery and more care. Armatures of very low resistance also offer greater difficulty.

Where two grounds are found to exist, as indicated by the change of location of both balancing points under the conditions before stated, when the battery contacts are shifted, the following mode of procedure will answer the purpose well, and is simple. Fix the battery contacts at any two points of the commutator nearly opposite each other, preferably at points to be determined by trial, that will cause the balancing points to fall nearly diametrically opposite to each other, and determine and mark the two balancing points, as then shown. Now place the battery contacts on the balancing points just found. If only one ground exists, the two balancing points and one battery contact will all be coincident in one point. If two grounds exist, both balancing points will be shifted from their former position. Open the armature circuit by unsoldering one of the ends of a coil connecting with the lead of the bar that is marked in the first part of this test as one of the balancing points. Place one of the battery contacts on the armature shaft and the other on the marked balancing point that is farthest from the point where the circuit has been opened. Next place one telephone terminal on the first bar to the right of the opened wire and draw the other terminal from the same point toward the right over the surface of the commutator. The telephone will be absolutely silent until the moving terminal has just passed the ground nearest to it, and strikes the first bar beyond the same, when it will click. This ground lies in the coil between this first bar giving a click and the one passed just previously, or else in the said previous bar.

The other ground is obviously to be located in a similar manner, by placing one telephone terminal on the bar just to the left of the open wire, and from that point searching toward the left with the other terminal. Only in cases where one ground is of very low, and one of very high, resistance will any difficulty be experienced in locating both accurately before either is removed.

The coils thus indicated may have their terminals unsoldered, when it can be readily ascertained with each whether the ground be in the coil or in the bar just preceding it.

If scientifically inclined, or if otherwise preferable, the circuit may be opened at a point somewhere midway between the two indicated coils instead of disconnecting those coils, and the exact location of each ground determined as follows: Take a piece

(Concluded on page 36.)

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CHANGES for advertisements must be in this office by Friday noon for the following week's issue.

NEW ADVERTISEMENTS should be in the office not later than Saturday noon to insure publication the following week.

NEW YORK, JULY 17, 1895.

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TELEPHONY IN GREAT BRITAIN.

We present in this issue an interesting review of the extended inquiry into the telephone situation in Great Britain recently held by a Committee of the House of Commons. The inquiry was provoked by the ambition of certain municipalities that, having attained some measure of success in the administration of other public services, were anxious to lay hands on the telephone, alleging their ability to supply a more efficient and cheaper service than that now furnished.

The evidence put forth in support of this contention was furnished exclusively by persons with a grievance and by faddists, who one and all exhibited a lamentable lack of knowledge of the subject and little appreciation of the scope of the work of a large telephone company. The rates of some of the systems in Continental Europe were set forth, without any detailed information in explanation of them, with a view of showing that government administrations give cheaper service than the English company; and estimates of the cost of new and untried systems were put in to show that much cheaper rates could be offered by the municipalities if they were allowed to go into the business.

In reply the National company put in an exhaustive and interesting answer which went far to show, by the figures given for increase of subscribers, traffic and operating efficiency, that there cannot be such widespread disapproval of rates and quality of service as the municipal faction had endeavored to make out.

The net result of the whole inquiry is that the pretentions of the municipalities to embark in the telephone business have received a *quietus*, that a general expression of opinion in favor of nationalization of the whole telephone system was brought out, and that the National Telephone Company have shown that their business in all respects compares by no means unfavorably with the telephone systems of other European countries.

We venture to predict that the committee will report emphatically against the granting of municipal licenses and more or less guardedly in favor of the acquisition of the whole telephone system by the government. It does not by any means follow, however, that the State will take over the National company's system at any early date. The present capital of that concern is in the neighborhood of $22,500,000, and for the British Parliament to vote a sum of any such proportions for the acquisition of a business, which popular clamor for low rates would almost certainly soon force it to run at a loss, is a most unlikely event. It would be flying too directly in the face of the experience resulting from the government purchase and administration of the telegraphs for one thing, and it would be disregarding the telephone experience of other European States, whose government telephone systems are notoriously operated at a loss and behind the times in efficiency.

The results achieved in this country by company management of the telephone are not sufficiently emphasized in these frequently recurring European discussions on telephone competition and government administration of the telephone. In the United States there has never been any question of government administration.

Further, rates in most places rule considerably higher than in Europe, comparing, as usual, without regard to conditions or to the relative value of money. Yet, in the United States to-day there are more exchange telephone subscribers than in Great Britain, Germany, France, Austria, Switzerland and Sweden all combined, and the equipment of the American systems and the service rendered are, by the testimony of all foreign experts, admittedly superior to those of any of the model European countries. This ought to be a strong enough argument for company management to convince anybody but a modern socialist. On a smaller scale Great Britain itself is also an argument for company management. The only European country which compares with it in number of subscribers is Germany, and of the whole number of subscribers in Germany 35 per cent are in two city systems, Berlin and Hamburg, where the rate is below the operating expenses.

Government administration of the telephone results in restricting the expansion of the business or in giving, at the expense of the taxpayer, the telephone subscriber more than he pays for—generally in a combination of both.

We note a growing appreciation of the value of water powers, heretofore idle and now considered in connection with electrical transmission. We predict a very large business for electrical manufacturers in this direction during the next few years. Look up the water power in your section and see if it can be utilized.

Merchants are beginning to learn that there is nothing more attractive to the public than a well-designed electric-lighted sign.

Wall Street and the Electrical Stock Market.

The crops of the country, according to the government and railroad reports, were never in better shape. Business in nearly all lines continues to improve. In some branches, notably iron and steel, wool and leather, there is a boom. Everything points to one of the most prosperous seasons which the country has ever experienced. Despite these facts the stock market was stationary at times and at others weak. This apparently anomalous condition is due to the aggressive attitude of the bear party, which, finding itself heavily short of the market, has been obliged to continue its selling in order to control the situation. Its operations were confined chiefly to the industrials. One after another stocks of that group were attacked with the hope of precipitating a general decline. Beyond working off the prices of sugar, gas and leather preferred, these efforts were attended by very little success. The operators demonstrated that stocks are strongly held. The shipment of $250,000 gold on Saturday was expected owing to the operations of the bond syndicate, which was supposed to control the exchange situation. The transaction, however, was made at a good profit. It is thought that the syndicate will take action which will prevent further exports and the surest way for it to do this would be to create a bull swing in stocks and bonds. There are many who look for such an occurrence, and believe that the start of such a movement will be the announcement of a plan to rehabilitate the anthracite coal industry which is now in the slough.

There was very little feature in the electrical stocks. General Electric recorded its highest prices early in the week and later lost about a point in sympathy with the decline in the other industrials.

A comparison between the General Electric and Westinghouse companies' financial condition shows the comparative strength of the two concerns, and the balance sheet and the ratio in which Westinghouse is taken as a unit and General Electric is expressed in terms of Westinghouse, follow:

ASSETS.

	General Electric.	Westinghouse.	Ratio.
Franchises & patents.	$ 8,159,264	$4,404,499	1.8 to 1
Manuf'ct'ring plants.	3,900,000	1,772,292	2.2 to 1
Real estate	423,783	464,403	
Stocks and bonds	5,079,012	4,903,793	.1 to 1
Cash	404,236	202,880	
Bills & accts. receivable	6,550,499	2,375,852	2.8 to 1
Inventories and work in progress	4,616,753	2,120,227	2.2 to 1
Miscellaneous	27,989	70,292	
Profit and loss	14,794,716		
Total	$43,956,258	$16,314,241	1.7 to 1

LIABILITIES.

Stock, common	$30,460,000	$5,336,351	
Stock, preferred	4,252,000	3,903,265	
Bonds	8,750,000	250,000	
Current liabilities	494,236	2,047,239	
Contingent liabilit's.		977,685	
Surplus		3,799,400	
Total	$43,956,258	$16,314,241	3.5 to 1

It will be seen that the ratio of General Electric liabilities to Westinghouse liabilities is three and one-half times greater while its assets are only 1.7 times greater.

The patent and franchise accounts are, of course, taken at the companies' valuations. It is claimed by many that those of Westinghouse are too low, owing to the Tesla patents, or that General Electric's are too high.

The income account of the two companies follows:

	General Electric.	Westinghouse.
Gross earnings	$12,961,213	.....
Operating expenses	11,451,863	.....
Net earnings	$1,509,350	$802,409
Other income	302,398	.....
All income	$1,811 748	$802,409
Fixed charges	464,588	69,060
Surp'us	$1,347,165	$733,349
Depreciation, etc	932,521	133,408
Actual surplus	$414,644	$599,941

Had it not been for the interruption of work incident to the construction of its new plant, Westinghouse earnings would have been better, and would probably have equaled those of General Electric.

The Street Railway and Illuminating properties, the funding company formed to furnish General Electric some $4,500,000 when it was in sore financial straits, in exchange for securities of a par value of twice that amount, this week canceled 1,007 shares of preferred stock issued against these securities, at an average price of $111.27. This makes 27,273 shares canceled to date, leaving 17,727 shares outstanding.

Edison Electric Illuminating of New York was quiet around par. The old 5's bonds were strong, advancing from 108¾ to 109½. The new consolidated 5's sold at 103½.

On the Boston Exchange, Bell Telephone rallied shortly from 194 to 197½, recovering the major portion of its dividend. There was no feature or change in Consolidated Electrical Storage. Erie Telephone at 57½, and New England Telephone at 46½, were unchanged. Westinghouse securities were strong and unchanged at 34 to 35 for the common, and 54 to 54½ for the preferred.

BAIN.

New York, July 13, 1895.

The Baltimore "American's" Electric Sign.

The Morrison Southern Electric Company, of Baltimore, Md., has recently erected for the Baltimore *American* a very attractive electric sign. The sign is 14 feet long and three feet high, and the block letters, each two feet six inches in height, made in proportion. The ground of the sign is a dead black and the letters a pure white. They are made of galvanized sheet-iron, pierced at intervals with porcelain waterproof receptacles for the electric lamps, 136 in number, each of eight candle-power. The lamps are frosted, making it appear as though the entire sign was formed of electric lights only.

In order to obtain the effect of appearing and disappearing, a revolving switch of eight circuits is used—a circuit for each letter of the word "American." The letter "A" remains lighted 108 seconds; the "M," 96 seconds; "E," 84 seconds; "R," 72 seconds; "I," 60 seconds; "C," 48 seconds; "A," 36 seconds; "N," 24 seconds, and the complete word 12 seconds. The interval the lights are all out is also 12 seconds. Electric current for the sign is supplied by the Maryland Electric Company, of which Mr. J. Frank Morrison is president.

PERSONAL.

City Electrician John P. Barrett, of Chicago, is spending a few weeks in the East.

Mr. S. F. B. Morse, of Chicago, was in New York last week and reports a good trade in Kerite wires and cables in his territory.

Dr. F. A. C. Perrine, professor of electrical engineering at Leland Stanford Junior University, Palo Alto, Cal., is visiting the East. Professor Perrine will spend the Summer on the New Jersey coast.

Mr. E. V. Cherry, president of the Standard Electric Company, of Cincinnati, Ohio, spent several days in New York and Boston last week. Mr. Cherry, who is one of the pioneer electrical manufacturers, reports a decided improvement in business in his part of the country.

Mr. E. L. Barr, well-known to the electrical trade through his former connection with the Canadian General Electric Company and more recently as traveling salesman for the Wallace Electric Company, of Chicago, has been elected secretary of the Wallace company *vice* Mr. Max A. Berg, resigned.

The son of Mr. Charles T. Yerkes is to be elected vice-president of the Siemens & Halske Electric Company of America, of Chicago. Vice-president Wright is quoted as saying: "We are going into the manufacture of locomotives on a scale as large as any American concern, except one, but that interest will be a side issue. The manufacture of electrical machinery will be the principal business of the company. Electrical construction is active and is destined to be more so. We intend to get some of the business if possible."

The University of Wisconsin has conferred the honorary degree of LL.D. upon two well-known men on account of their great services in the interest of engineering and the industries. The first of these men is Edwin R. Reynolds, of Milwaukee, Wis., designer and builder of the Reynolds-Corliss engine. The degree was conferred upon Mr. Reynolds in recognition of his position as an expert of the highest rank and of international authority as a steam engineer, and on account of his remarkable ability and success as a designer and inventor. The second of these men is Don J. Whittemore, of Milwaukee, Wis., chief engineer of the Chicago, Milwaukee & St. Paul Railway. The degree was conferred upon him in recognition of his distinguished services in the railway interests of the country.

In Philadelphia, the other day, says an exchange, an old lady from the country took her stand directly in the center of a trolley track. She soon spied a messenger boy, who, with hat perched on one side, was coming along whistling a popular air. "Say, little boy," inquired the old lady, "would you tell me where I could get a trolley car?" "Yes, ma'am," was the prompt reply; "stand where you are an' you'll get one right in the neck."

TELEPHONE NEWS AND COMMENT.

Communication by telephone between London and Dublin was opened on July 12.

It is reported that the Harrison Telephone Company, of Chicago, will reduce its capital stock one-half again, bringing it down to $20,000,000.

John W. Mackay authorizes the statement that there is no truth in the report that the Postal Telegraph Company has been offered $15,000,000 for a controlling interest by the Standard Telephone Company.

The City Council of Trinidad, Col., has granted a 15-year franchise for a telephone system to the Citizens' Telephone Company. The company solicits correspondence regarding construction and equipment of the system.

Bennett's "The Telephone Systems of the Continent of Europe" is meeting with great favor among telephone people. The ELECTRICAL REVIEW has already supplied the principal telephone libraries with this book, which is sent post free on receipt of the price, $4,50. It contains unusually valuable data on telephone matters in European countries.

Plans for the Central New York Telephone and Telegraph Company's new building on Montgomery street, Syracuse, were submitted to the Board of Directors at a meeting held on July 10 and accepted; it is proposed to have as complete and serviceable a telephone system as is possible. The building will be of fire-proof construction, four stories high, and work will be commenced in a few weeks. The directors propose within another year to have as complete and as serviceable a telephone system as can be established. Improvements are being made every mouth or two. A copper metallic circuit, connecting Syracuse, Auburn and Skaneateles was completed on July 10.

The Nixon Telephone and Electrical Supply Company, of Providence, R. I., have patented a new system of telephoning for railway purposes, which they exhibited to a party of representative business men of Providence and Newport in Newport, R. I., on July 8. A short time ago the Nixon company arranged with the Newport Electric Railway Company to erect their test line upon their iron trolley poles, the test line running from the waiting room on Spring street to the beach, and a loop out to the ball grounds, and the call boxes were placed at each switch. The advantages claimed for the new system are that by placing the boxes upon every second or third pole along the line of a railway, in case of an accident of any kind, the conductor of the train can telephone immediately to the superintendent or train dispatcher, thereby saving both time and expense; and the track inspector, in case he finds a broken rail or any obstruction upon the track, can notify the office at once. The system is composed of one wire, which loops on itself.

LOCATION OF GROUNDS IN ARMATURES, FIELDS, ETC.

(*Concluded from page 33.*)

of "broom wire" about 18 inches long, new and clean, screw the ends firmly into two clean, brass table binding posts, and into the other holes of the same posts screw the battery terminals. Have an assistant press the corners of the bases of the binding posts into very firm contact with the two bars that lie at the ends of the indicated coil, observing the directions previously given for securing clean contact. Place one telephone terminal in contact with the shaft, and with the other find the balancing point on the wire. This point will indicate the relative position of the ground in the coil, or commutator bar, as the case may be. If more than two grounds were suspected, the two lying the farthest apart would be approximately located by the first part of the two ground process, and if these coils were not disconnected before proceeding farther, it would be well to make two openings in the circuit, close to and lying between these outer grounds, then locate definitely these two extreme grounds and proceed with the remaining section somewhat as with a complete armature, except that you would commence by connecting the battery to the terminals of this section, and would then bridge the telephone from the shaft to the different portions of the section, and would complete the process by applying the remainder of the two-ground test.

In dealing with a cross-connected gramme ring, an obvious change would be made in the points of application of the battery, and as many points of apparent trouble would be indicated as there were series of cross-connections.

After location of these points it would be necessary to use the auxiliary wire loop, as before described, between these points, to determine which is nearest the trouble. This fact being determined, it would in case of a single ground (indicated by the permanency of the balancing point) become necessary to remove the cross-connections from two bars before proceeding farther. The auxiliary wire loop would properly be used to complete the process.

The ordinary "closed coil" ring or drum armatures are types to which these methods are directly applicable.

The sections of open coil armatures would receive the same treatment as field coils.

Familiarity with any special forms of armature will doubtless suggest to the ingenious mind modifications of these methods suited to those forms, but it would be improper to attempt here to deal with specialties whose names are legion.

Where wet grounds exist it will always be better, when practicable, to dry them out before making the final test, as certain sections may show faults which will not be permanent. Wet grounds will, of course, give a click in the telephone when bridged from the commutator to the shaft when no battery is attached, owing to galvanic action of the water on the copper winding and the iron core.

Whenever necessary to deal with wet grounds in testing, it is better to make at least four tests, reversing the battery after each test, and taking the mean of the four determinations.

Field coils, also any wires of uniform cross-section, the extremities of which are accessible and within a reasonable distance of each other, can, of course, be easily tested for grounds by soldering or firmly clamping a bare wire of suitable size between the extremities of the conductor to be tested, applying a battery to the junctions, and bridging with the telephone between the bare wire and the object upon which the conductor is grounded. This will give only the location of a single ground, or the "resultant" of two grounds. A "Thomson-Houston" rheostat should have the battery connected to the two extremities, and the point of apparent ground determined by bridging with a telephone between the frame and the several contact plates. Then apply the battery to the frame and point of apparent ground, connect one terminal of the telephone with each extremity successively, and search from it toward the center with the other terminal, as in the case of searching for two grounds in an armature.

In determining the location of grounds that are of very low resistance, a good induction coil similar to that used in the Blake transmitter may be used with advantage in connection with the telephone receiver. The receiver is placed in circuit with the secondary of the coil, and the "bridging" is done with the primary. With high resistance grounds the best results are obtained by using the receiver only.

ELECTRIC LIGHT FLASHES.

The Edison Electric Illuminating Company of Brooklyn, N. Y., makes the following showing for June:

	1895.	1894.	Inc.	Dec.
Gross.....	$33,023	$24,004	$9,018	.....
Net.....	11,667	11,786	.....	$119

Representatives of the Edison Electric Illuminating Company of Brooklyn, N. Y., last week protested before the Board of Assessors against the big increase in the assessment on its property this year, and threatened to transfer their office to another city unless a reduction is made.

The Edison Electric Illuminating Company of New York makes the following statement of earnings including the Harlem and Manhattan companies:

	1895	1894	Increase.
Gross, June.....	$135,579.90	$123,193.30	$12,686.60
Net, June.....	69,960.51	58,888.54	10,980.97
Gross, 6 months.	947,445.06	825,338.43	122,106.63
Net, 6 months ...	474,895.69	409,639.36	65,256.33

Work is fast progressing on the electric power transmission plant which is to carry water from the North Fork of the San Joaquin River, 33 miles distant, to Fresno, Cal. It is to be in operation within 120 days, and is to deliver from 1,000 to 1,200 horse-power in Fresno. It will supply 1,000 incandescent lights, 160 arc lights and motors for flour mills, planing mills and various other purposes, with a reserve for street railroads.

Who Has Seen This Wonder?

[*From the Queensland, Australia, Electric Telegraph Gazette.*]

A figure moving by electricity, measuring six feet in height and singing English songs and snatches from Italian operas, has been perambulating the streets of New York. The electric man moves his head, arms and legs as though instinct with life, and can walk about 12 miles an hour. The figure is attired in evening dress, with a white necktie, the boots are made of iron, with soles of very strong and durable leather. The motion of the arms and legs is performed with the greatest regularity, so that the automaton never loses its balance, even when going at a great speed. When singing its mouth opens and closes as occasion requires.

Mr. Fukuzawa Entertains Col. Cockerill of The New York "Herald."

Mr. Yukichi Fukuzawa, of Tokio, Japan, is called the "Grand Old Man" of Japan and is known all over the empire as "Sensei," meaning "our master" or "savant." He is the head of a great university in Tokio and is the proprietor of Tokio's leading native newspaper, the *Jiji Shimpo*. Perhaps his greatest service to Japan was the introduction of the English language into the country, the first English book ever taken there being Webster's dictionary which Mr. Fukuzawa purchased while on a visit to the United States and carried back with him.

His son, Mr. Stejiro Fukuzawa, is now managing editor of the *Jiji Shimpo* and was educated in the United States. He was graduated from the Massachusetts Institute of Technology with high honors as a civil engineer. After a year spent in traveling, he returned to Japan to practice his profession and later entered journalism by becoming a member of the staff on his father's paper. While in college Mr. Fukuzawa and Mr. Coles, of the ELECTRICAL REVIEW, became intimate friends and when both entered journalism an exchange of their respective papers was commenced. The *Jiji Shimpo* is regularly received at the ELECTRICAL REVIEW office and is read with great interest and much hesitation.

When Mr. James Gordon Bennett secured the services of Col. John A. Cockerill as the New York *Herald's* special representative in Japan, the Colonel took with him to Tokio a letter of introduction from Mr. Coles to Mr. S. Fukuzawa. Col. Cockerill received the usual hearty welcome accorded at all times by Japanese to Americans and especially to one who represents the *Herald*. The *Jiji Shimpo* of June 9 contains an account of a dinner given to Col. Cockerill by Mr. Yukichi Fukuzawa. The account is translated below for the benefit of Col. Cockerill's many friends in the electrical field in this country, the exact wording being followed:

Day before yesterday Mr. Fukuzawa invited Mr. Cockerill, of the New York *Herald*, and special correspondent of that paper, who has been speaking in high terms as to our government's action from the time of commencement of the Japan-China war, and General George B. Williams, formerly adviser to the Japanese Minister of Finance and now largely in shipbuilding in the United States. By this chance Mr. Fukuzawa introduced them to the men of note in the city, of which Messrs. E. Shibusawa, W. Morioka, I. Morimura, H. Shoda, I. Abe, H. Wankanigawa, H. Iwasaki, T. Masuda, E. Asabuki, R. Toyokawa, S. Yoshitake, I. Yamamoto, and others, about 30 persons joined. Entertainment commenced about 5 o'clock and lasted until 10 P. M., taking much enjoyment. General Williams having lived long in Japan before had some knowledge of Japanese language and was rather accustomed with Japanese food. On the other hand Colonel Cockerill would have felt quite curious with every one of the Japanese dishes, as he is a gentleman newly arrived to Japan and consequently has no former taste to Japanese food. But he had many cups of sake and took sashimi (slices of raw fish) and siumono (soup) as if they have been delicacies to the taste of him. While receiving and returning sake cups he learned Japanese etiquette and custom which caused general applause among folks in the place.

OUR BOSTON LETTER.

Currier, Mayo & Company, the enterprising engineering and contracting firm of this city, are doing a splendid business at this time, and report the outlook for Fall trade as exceptionally good. Among their recent installations of importance is the plant of the Cottage City Street Railway Company, of which they furnished the entire power equipment, including the erection of the power house. The road was opened for business about the 15th of last month. McIntosh & Seymour single cylinder engines of 150 horse-power are part of the equipment. Another plant which is well along towards completion is that of the Gloucester, Essex & Beverly road, where they have put in two 300 horse-power McIntosh & Seymour compound-condensing engines direct connected to Walker Manufacturing Company's 200 kilowatt generators. Another installation just completed and now in operation is the isolated lighting plant in the Lauderdale Building, Providence, R. I. This plant consists of two 13 x 12 McIntosh & Seymour direct-connected engines of 90 horse-power each and Mather machines. A 325 horse-power McIntosh & Seymour engine has been put in the power house of the Wakefield & Stoneham Street Railway Company and a duplicate order received from the Boston Electric Lighting Company for two compound-condensing engines of 400 horse-power each. An order is also in hand for two special direct-connected engines of 55 horse-power each for the Tremont Temple in this city for lighting purposes, and a 2,150 horse-power four-cylinder triple-expansion engine of the vertical type has been sold to the Amoskeag Manufacturing Company, of Manchester. Another installation just completed is that of the power plant for the South Middlesex Street Railway Company at South Framingham, consisting of two Corliss engines and bank of Hazleton boilers. Currier, Mayo & Company are among the most enterprising concerns of New England and are always to be found at the front when contracts in their line are to be awarded.

J. A. Grant & Company, agents for the Hamilton-Corliss engines in this section, report the following as among their recent installations: A pair of 400 horse-power single cylinder engines for the Pawcatuck Street Railway Company; 150 horse-power to Cornelius Murphy, Beverly, Mass.; 50 horse-power to Maine State College; and 100 horse-power to Kelley & Greene, Lynn, Mass. H. G. T.

Boston, July 13.

The Callender Automatic Telephone Exchange System.

Statistics show the general average of telephones in use at one time to be not more than 20 per cent of the total number constituting the exchange. The Callender system is founded upon this percentage basis and provides mechanism enough to do the estimated maximum business at any busy portion of the day. Instead of an individual mechanism for each subscriber a percentage only of mechanisms is provided. The whole of these mechanisms are for the common use of all telephones in the system, provision being made by which a telephone subscriber on turning in a call to the exchange individualizes for his own use one of the common mechanisms not in use at the time his call arrives.

The illustration, Fig. 2, shows the

FIG. 1.—CALLENDER SIGNALING TRANSMITTER.

system now being exhibited in the Decker Building, Union Square, New York. The greater part of this installation has capacity enough for doing the business of an exchange of 1,000 telephones, the remaining portions having a capacity of from 300 to 600 telephones.

An important feature of the percentage system is the low cost of installation, and as the price per subscriber becomes less as the size of the system increases the claim is made that it will materially aid in lowering telephone rates in large cities, especially, where under the present system it is not possible.

The illustration of the signaling transmitter, Fig. 1, together with its call bell and telephone transmitter and receiver, shows the means used for turning in a call to the exchange. It will be noticed that no special care or skill is required in signaling for connection with another telephone, the whole act consisting in setting the combination of numerals on the indicator switches and in then drawing down the actuating lever at the side. The automatic signals received from the central office are, one long ring for "connection established" and two rings, a busy signal, for "line called for in use."

"A Breezy Editorial."

[*From the Architects' Electrical Bulletin.*]

Without any desire to give a forced draft meaning to the phrase "a breezy editorial," it seems to us that it may well apply to a few remarks on the success of electrical ventilation. The subject of ventilation is one that architects always have to study and to which electricians have of late been led to give a great deal of thought. There can be no question that the possession of new facilities has brought about a remarkable improvement in methods of purifying, heating and cooling the air, and that the modifications due to the use of electrical power are among the most important of recent years.

It is, indeed, a rare thing nowadays to find plans of new buildings of any magnitude in which provision is not made for the exhaustion of bad air and the introduction of new by means of ventilating fans driven by electric motors. The appliances for the purpose are so compact, convenient and economical that to omit them is to show that one has not kept pace with the arts and that the architect does not avail himself of all the modern resources. Even in works that partake as much of engineering as of architecture—the new subway, for example, under the Boston Common and Public Garden—much of the success of the plan appears to depend on electrical ventilating, without which the comfort of the people would certainly be much less. It remains a remarkable fact that many of our railroad tunnels, such as the New York Central's entry into the metropolis, are not furnished, when they might easily be so, with electrical exhaust devices for getting rid of the foul air. As each of the big locomotives going through the Harlem tunnel vitiates as much air as would 87,000 persons, the necessity of a resort to electricity, not less for traction than for ventilation, is voiced by every dictate of common sense and sanitation.

It is when we turn to the fan motor and contemplate its wonderful triumph, that the value of electricity to the architect and sanitary engineer becomes most apparent. Ten years have seen the fan motor become one of the best known and most popular of electrical devices, and the recent perfections in its design and finish have broadened the market for it marvelously. The man who has a fan motor in his house or office each Summer regards the hot weather with equanimity; he who is without the cooling appliance is to be commiserated. Many sick rooms are now rendered tolerable to the patient in hot weather by the fan, and even in the kitchen the cook is often placated and retained through the soothing agency of the little fan motor up in a retired corner. When we remember the industrious fanning, with palm leaves, of bygone years; the clockwork fans; the giddily pirouetting blades on restaurant ceilings, and the total absence of cooling methods for small rooms and offices, the modern era with its little electric fan motor must be reckoned an enormous advance in the art of living.

But the fan motor is not yet half as well patronized as it ought to be. The time is coming when it will be as numerous and countless as the sewing machine, but to that end it is necessary that houses and large buildings shall all be wired, and that everybody shall have current available. The architect has a duty here not only in seeing that his new buildings are wired for electricity, but that they are wired properly. Many new structures that just at the moment are beyond the reach of electric circuits will soon have the current brought to them either by direct wire or through the instrumentality of the storage battery, and it is well to prepare for the opportunity. No one who has enjoyed the electric light likes to dispense with it, no one who has "cooled off" in a fan-motor breeze cares to think of hot days and nights without such relief. But one can still go to fine new hotels and find their bedrooms without fan motors and even their cafés without such conveniences; and the excuse is sometimes offered that the architect made no provision for them. This may be true or it may not, but we believe that any place of public resort will find it pays to render the Summer hours in its precincts cool, and that architects can add to their laurels and reputation by helping to devise new ways of rendering the fan motor useful as well as ornamental.

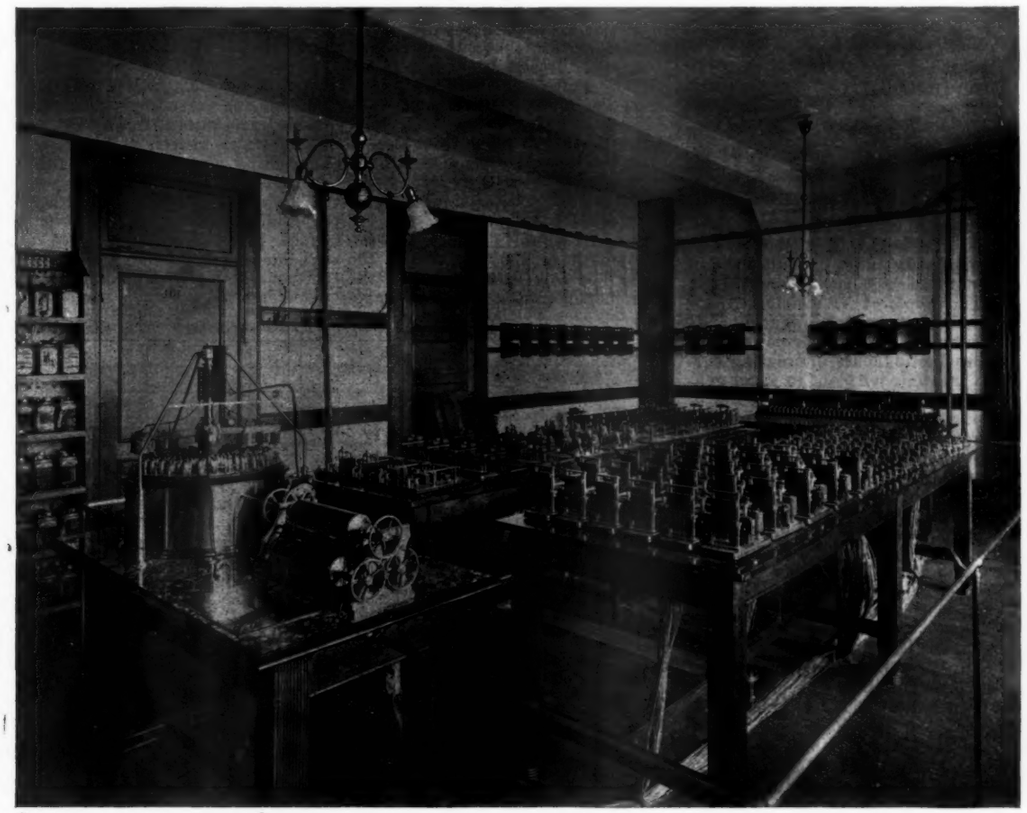

FIG. 2.—EXHIBITION OF THE CALLENDER AUTOMATIC TELEPHONE SYSTEM.

The Edison Electric Illuminating Company of New York has declared a quarterly dividend of one and one-half per cent, payable August 1. Books close July 15 and reopen August 2.

LONG DISTANCE TRANSMISSION AT TEN THOUSAND VOLTS— THE POMONA PLANT.

READ BEFORE THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, NIAGARA FALLS, N. Y., JUNE 27, 1895, BY GEORGE HERBERT WINSLOW.

The Pomona plant was installed in the Summer and Fall of 1892 for the San Antonio Light and Power Company, of Pomona, Cal. It was increased in the following Spring, and early last year the capacity of the plant was doubled by duplicating the entire equipment. At the present time, when the plant has been in regular operation for more than two years, and its complete success has established confidence in the successful outcome of many similar projects of greater magnitude, it seems fitting to present a careful description of the entire installation. The electric plant was installed under the personal direction of the writer, as electrical engineer, who presents many of his personal observations on its construction and operation.

The plant is used to transmit energy from a waterfall to sub-stations at Pomona, 13¾ miles distant, and San Bernardino, 28¾ miles distant, from which points it is distributed for incandescent and arc lighting. It consists of a Pelton water-power plant and a Westinghouse alternating current transmission plant in which generators supply current to sets of raising and lowering transformers operating at 10,000 volts and delivering current to the local circuits at 1,000 volts.

The water power for this plant is derived from the San Antonio creek, which is chiefly supplied by the melting snows and the rains on San Antonio Mountain. Side canyons, however, also furnish some water. The creek flows for several miles through a narrow valley at the upper end of the San Antonio canyon in a bed which it has washed for itself in the layer of boulders and gravel formed by the action of an immensely larger stream in past ages.

At the lower end of the valley a sharp ridge extends eastward from the side of a neighboring mountain, from which it originally split off, and blocks up the valley except at a narrow place at which bed-rock is exposed and through which the stream plunges suddenly downward at least 90 feet between precipitous walls of rock, forming the San Antonio Falls.

To utilize this fall, part of the water is diverted by a dam about 200 feet above the falls into a canal which conducts the water to a tunnel passing through the ridge. At the other end of this tunnel the water enters a large pipe leading to the power house, which is located 412 feet below the level of the outlet of the tunnel.

A vertical projection of the pipe-line, giving the sizes of the pipe, is shown in Fig. 1.

The pipe is of sheet steel, double-riveted throughout, and was delivered on the ground in sections having a length of 11 feet six inches. These sections consist of four sheets each three feet long.

The diameter of the pipe up to within 450 feet of the power house is 30 inches, with the exception of the length which connects it to the sand-box at the top of the pipe, which length is considerably expanded, so as to allow the water to flow slower on entering, and thus to reduce the entrainment of air. Near the power house a "reducer" is inserted in the pipe to reduce the diameter to 24 inches, and this size is maintained from this point to the power house. The pipe was designed to carry 2,000 miner's inches of water (measured under a head of six inches), without unnecessary loss by friction. The capacity is equivalent to 50 cubic feet per second, or 1,882 horse-power at 390 feet effective head, assuming a wheel efficiency of 85 per cent. This is nearly three times the power for which the present station was built, but the extra capacity of 1,000 horse-power obtained by increasing the capacity of the pipe costs so little when compared with the cost of building an entire new pipe-line, that it is much more profitable to lay the larger pipe in the first place, if sufficient water can ultimately be developed to utilize the added capacity.

The thickness of the pipe is increased as it nears the power house to provide for the increase in pressure in the lower parts. At the first bend it is made greater than that of the sections above it on either side, because the pressure on it is greater. After passing the second air-valve first No. 10 and then No. 8 steel is used, the latter size being continued to within a short distance of the power house. The last few lengths are of No. 6 steel.

The horizontal distance between the mouth of the tunnel and the power house is 1,940 feet, and the difference in level between the tunnel and the floor of the power house is 412 feet. The total length of the pipe, following the line, is 2,370 feet.

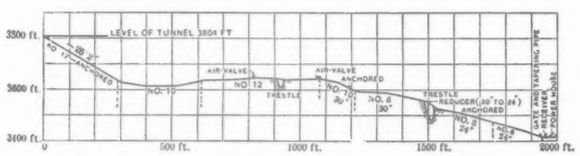

FIG. 1.—PIPE LINE, POMONA PLANT. HEAD 398 FEET.

The sections of pipe as received from the makers were coated with asphalt both inside and out, and parts of this coat were, of course, scraped off through rough handling. After the pipe was laid and jointed, a man went through it and painted the joints with hot asphalt to prevent rusting.

In order to protect the pipe from the great changes in temperature which occur in the mountains between midday and midnight, earth and loose rock were placed around and on top of the pipe without any tamping, and where enough earth could not be conveniently obtained, brush was cut and piled on the pipe and covered with a light layer of earth and rock.

The lower end of the pipe is closed by means of a 24-inch Ludlow gate-valve, which is bolted to a cast-iron flange riveted to the end of the pipe.

The stem of the valve is geared to a small hand-wheel, partly on account of its weight, but chiefly in order that the gate may not be shut too quickly, as otherwise the pipe would be subjected to severe strains, resulting from suddenly checking the velocity of the column of water. For use under heavy pressures the gearing is also necessary in order to be able to move the valve at all. The head of water on this plant is so great that it is impossible to open the valve when the pipe is full, and, after closing the valve, it is necessary, before raising it, to partially empty the pipe by means of a relief-valve attached to the pipe close to the gate. The relief-valve is primarily designed to protect the pipe from shock by allowing the escape of a considerable quantity of water in case of an increase of pressure in the pipe; such, for example, as would occur should any obstruction partially close the opening of the gate. It has a circular valve so proportioned that a slight movement of it will afford a large opening for discharge. The valve is held in place by a weighted lever, and is set so that a very slight increase above normal pressure will cause it to open.

The gate is connected by a tapering pipe of steel to a horizontal, cylindrical steel receiver 20 feet long and 42 inches inside diameter, from which the water is distributed to the wheels. The object of such a large receiver is to avoid the loss in head which would be occasioned by the eddies formed when drawing the water from the side of a smaller pipe. It also serves to keep air from being drawn into the discharge pipes in case it accumulates in the receiver.

Two tapering cast-iron pipes (a large and small one) are bolted to the lower side of the receiver at an angle of 30 degrees. These pipes conduct the water from the receiver to the under sides of two independent Pelton water wheels, which drive an alternating current generator and its exciter.

To the end of each pipe is attached a Ludlow gate-valve, the stem of which passes horizontally into the dynamo room through a bushing in the concrete wall. The larger of the two stems is geared to a hand-wheel; the other is fastened directly to a smaller hand-wheel. The flow from each pipe can thus be completely controlled from the dynamo room. The pipe running to the generator wheel is provided below its valve with two nozzles cast in one piece and attached to the valve by means of a limited ball-and-socket joint, which permits them to be moved vertically to deflect the water. (See Fig. 2.)

The pipe supplying the exciter wheel has below its gate a throttle valve, the stem of which passes through the wall into the dynamo room, where it can be connected to a governor. The wheels are located directly below and in the plane of the receiver and above a raceway which conducts away the water after it drops from the wheels.

The speed of a Pelton wheel is dependent for a given load and head of water upon the amount of water striking the wheel, and therefore to maintain a constant speed this amount must be changed every time the load changes, and in proportion to the latter. In the case of the generator wheel this change is produced by deflecting the water. Constant speed regulation may also be obtained by throttling the water, as is done in the case of the exciter wheel. When the water is throttled there is loss in efficiency due partly to the scattering of the water as it flows from an aperture which it no longer completely fills (which causes much water to miss the buckets), and partly to the loss of head caused by friction in passing through the valve. With the deflecting nozzle there is no loss of efficiency due to this cause. There is, however, a great waste of water at light loads, since under a constant head the same quantity of water must be disposed of at all loads, and for light loads the greater part of it is wasted. To avoid this loss the use of a reservoir naturally suggests itself. It is an unfortunate fact, however, that high heads are confined to mountainous countries and that there a reservoir usually necessitates a high and consequently costly dam. The necessity of building a dam to withstand freshets so increases its cost as to make the use of a reservoir commercially impossible with high heads. Therefore, the water must continue to be wasted, and the chief apparent objection to deflecting nozzles is seen to be of no importance.

A set of tips of different diameters is supplied with each nozzle, so that the size of the jet used may correspond to the maximum load and thus unnecessary waste of water be avoided. The tips for the generator wheel range from one and one-half to two and one-half inches in diameter, while those for the exciter are from seven-sixteenths to three-quarters of an inch. When tips are used of the proper size for the full load there is no need of throttling at the full load, and, therefore, no loss from this cause; and with the deflecting nozzle there is no waste of water at full load, so that for full load the two arrangements are equally good. This is not, however, the normal condition of operation of a lighting plant, for in such a plant each dynamo is driven by a separate wheel, and the load is constantly changing, so that here the deflecting nozzle has the advantage. The deflecting nozzle is also to be preferred under high heads, to avoid the risk of straining the pipe by suddenly checking the flow of water, as would be necessary with a throttle valve if the entire load were suddenly thrown off.

Regulation by throttling is, therefore, only advisable in cases where the head is not excessive, and where the quantity of water obtainable is limited, as is the case where it has to be stored in and supplied from reservoirs, or when the supply is liable to sudden stoppage. The writer recalls instances of its value in cases which occurred while he was at Bodie, Cal., in the Fall of 1893. There the water was conducted 4,700 feet in an open ditch to the pipe, and was delivered by the pipe under 350 feet head to drive an electric generator for a 12-mile synchronous power transmission. In cold weather anchor ice would form and suddenly block up the ditch at some curve, and the water pressure would begin to fall slowly owing to the gradual emptying of the pipe, which could no longer be kept full by the diminished flow from the lower end of the ditch, which now acted as a reservoir. Having throttle valves in the nozzle, however, very little water was wasted, and the plant was thus kept running until the ditch was cleared, whereas with a deflecting nozzle the pipe would have been quickly emptied, even if the gate valves had been used as throttling valves (which is feasible if the load only varies slightly). Sometimes the head became so low that it was necessary to throw off part of the load and to run at reduced speed, to keep the motor in synchronism.

As already stated, the speed of the generating wheel is maintained constant for different loads by deflecting the stream. This is done by raising or lowering the deflecting nozzles from the dynamo room by means of a lever fixed to a shaft which passes through the wall and carries a short lever connected to the nozzles by a link. The weight of the nozzles is counter-balanced by a movable weight on a horizontal lever arm fixed to the shaft. The change of position of the nozzles is made automatically by the

use of the Pelton differential governor. The ability of this governor to keep the generator at a practically constant speed depends on the governor being driven at a constant speed. I say practically constant, for there must be some change in speed before the governor can act, and then an appreciable time is required for this action to produce its effect. The constant driving speed in the present case is furnished by the exciter wheel shaft. The arrangement for governing is briefly as follows: The generator is geared to stop itself by turning the water off the wheel and the source of constant speed is geared to speed up the generator by a contrary action. These two actions neutralize each other when the generator speed is the same as the fixed speed, but when either preponderates the difference acts. Thus an increase in generator speed will act to stop the generator, while a decrease, by making the fixed speed predominate, acts to speed up the generator. The governor consists, in part, of two similar miter-wheels which are mounted upon pulleys and placed face to face, loosely, upon a horizontal shaft, and are driven at equal speeds in opposite directions, one by the generator shaft and the other by the exciter shaft. The speed of the pulleys is 200 revolutions per minute. In Fig. 3 it will be seen that between these wheels, and at right angles to the supporting shaft, there is fixed to the latter a cross-bar carrying two miter-wheels, one at each end, which mesh with the two oppositely revolving miter-wheels first mentioned. The result is, as long as the two outside wheels are revolving at the same speed, the two central wheels will merely revolve upon their axis without tending to move in either direction the arms upon which they rotate. Now, if the generator speed increases, the corresponding side of each central wheel will have to travel faster forward than the other side travels backward, and the difference between these two movements will result in a movement of the central wheels in the direction of a faster wheel, and the cross-bar will consequently move the same way. The shaft to which the cross-bar is attached will, of course, turn with it, and as this carries a pinion meshing in a toothed quadrant connected to the lever which controls the nozzles, the stream will be pulled away from the wheel until the generator speed falls to its normal value. This point is quickly reached with a full load, owing to the drag of the load, but for a light load the inertia of the armature and wheel prevent them from responding so readily, and so makes the governor act longer than it should. Consequently the generator is not only brought to its proper speed, but is carried past it, which causes the governor to reverse, and sets up a regular see-sawing in the speed. This see-sawing is increased by a certain amount of lost motion which exists in the governor and its connections, and by the action due to the fact that for a full head and light load the jets only impinge slightly on the buckets, and since the jets are round and their upper edges alone strike the buckets (which are themselves curved in the opposite direction), a slight movement of the governor produces a much greater change in the speed of the wheel under light loads than when the whole of each jet is in use. This effect of the jets is more marked when the governor is working to cut down the speed than when it is increasing the speed, because withdrawing the jets a given distance causes a greater change in the quantity of water striking the buckets than would be caused by advancing the jets an equal distance. The see-sawing will be further increased if the nozzles are not fully counterbalanced, as they would then tend to fall away from the wheel.

In order to avoid see-sawing it is the practice in this plant to reduce the head every morning during the light load. This is readily done by opening the extra four-inch relief-valve and allowing water to escape until the pressure has gone down to that corresponding to the desired head. The valve is then set tentatively until the pressure remains about constant, when the final adjustment is made by partly closing the valve on the generator-wheel pipe. Meanwhile the governor throws more and more of the stream onto the

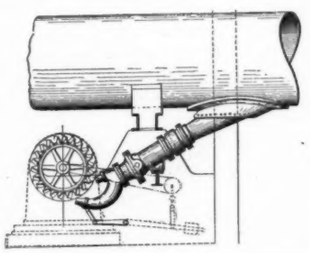

FIG. 2.—WATER-WHEEL WITH DEFLECTING NOZZLE.

wheel to compensate for the decrease in head, and the see-sawing stops. Where a deflective double nozzle is used it would seem advisable to have in the upper branch a throttle valve so connected to the deflecting levers that when running under light load the valve would be entirely closed and the regulation be attained by deflecting the open nozzle. When the whole stream of this nozzle had come into use and more water was required, the valve would be open. In this way the water would be used during light load under more favorable conditions than obtained with a simple deflecting nozzle, see-sawing would be avoided, and in case the supply of water became less, either suddenly, as by a sharp freeze, or gradually, because of diminished rainfall, the water would be used most economically and efficiently during the time of maximum load, which is the critical time. The effect of such an arrangement of the nozzles and valves would be to increase the capacity of the plant for a given minimum water supply, the period of minimum supply being precisely that in which all possible economies are of value. It may be objected that tips of such a size be used as would bring both streams into full use during maximum load, and that then no valves would be required, but against this is the fact that the maximum load (particularly in a lighting plant) does not reach the same value every night and that it is, therefore, always necessary to use tips large enough to meet the possible demand of any night.

In order to avoid breaking the teeth of the quadrant in case the governor should continue to act after it has moved the nozzles to either their highest or lowest point, the pinion on the governor shaft is mounted loosely between the two laterally movable toothed ratchets which normally hold it in a fixed position, but either of which will be automatically disengaged by an adjustable lug on the corresponding side and end of the quadrant when the latter reaches either of its extreme positions, and will thus allow the pinion to stop, though the shaft continues to turn. Both ratchets may be instantly disengaged by hand and the position of the nozzles be regulated by a hand-lever when starting up, or in case of accident to belts or of decrease in head of water.

To start the plant the governor ratchets are first disengaged and the exciter is brought to a moderate speed; the generator is then started and its field is charged; it is then brought to about three-fourths of its full speed, and the speed of the exciter is then slowly increased until the cross-bar on the governor ceases to move. At this moment the ratchets are thrown in, and the governor takes charge of the generator speed. The speed of the exciter is now slowly increased to its full value, which of course brings the generator to full speed.

The speed of the exciter-wheel is regulated by a small throttle valve, the changes in the position of which do not have any noticeable effect on the pressure in the pipe, owing to the small size of the jet controlled. This valve is so made as to have an equal pressure on each side of its axis when partly open, and hence can be moved from one position to another with little effort, which makes it of special value for use with automatic governors. When tightly closed, however, the areas subjected to pressure are no longer equal, and the valve sticks tightly. To obviate this the edges of the valve are battered slightly so as to prevent it from being completely closed.

An effort was made to automatically govern the exciter by means of a ball governor driven by a belt from the exciter-wheel shaft and actuating the valve by means of two leather friction cones acting alternately on a beveled disk geared to the valve, but this proved unsatisfactory and was finally discarded, chiefly on account of the difficulty of maintaining the

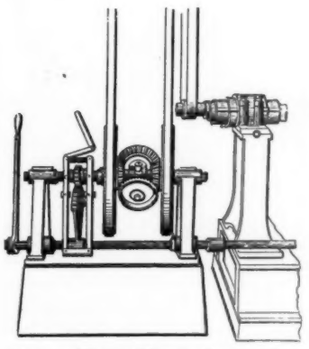

FIG. 3.—WATER-WHEEL GOVERNOR.

proper adjustment, by reason of the wearing away of the cones and of their swelling from dampness. The exciter was, therefore, controlled directly by hand for a long time. At present the valve is worked from a distance by a simple electrical arrangement devised by Mr. Imlay, in which advantage is taken of the fact that when the exciter is at full speed the movements of the valve necessary to regulate the speed are small.

The device consists essentially of two fixed solenoids in series, energized by current from the exciter and normally acting with equal force on two iron cores supported respectively at the opposite ends of a walking-beam connected by levers to the valve, their normal function being to keep the valve stationary. Either of the coils may be short-circuited at will by means of a relay controlled by two keys and likewise actuated by current from the exciter. When either coil is short-circuited it ceases to hold its core, and the core on the other end of the walking-beam is pulled down by its own coil, thereby turning the valve in a corresponding direction. In order that this movement may not be too rapid the coils and cores are immersed in oil, which causes the coils to act as dash-pots to the cores; by this means the movement of the valve may be made as slight as is desired.

The relay is not really necessary, but was used to break the circuit in experiments made before the plan of short-circuiting one coil was devised, and has been retained because very convenient. A momentary closing of either key suffices to correct any change of speed, such changes being indicated by the compensating voltmeter. The current in the coils is reduced by a resistance in series with them about equal to that of one coil, and the current for the relay is shunted from the resistance at about two volts. The current normally passing through the coils and resistance is about two amperes at 100 volts (about one-quarter horse-power) and when one coil is short-circuited the current in the other increases to three amperes, so that the maximum power used is two-fifths horse-power.

(To be continued.)

Electricity on the New York, New Haven & Hartford Railroad.

Vice-President John M. Hall, of the New York, New Haven & Hartford Railroad, when asked last week if the electrically-equipped Nantasket Beach branch of his road was operating successfully, said: "Thus far the results have been very satisfactory. We are now awaiting statistics from the Nantasket branch which will determine with more accurate definiteness whether the electrical equipment has proved the thorough success which has been claimed since the branch was started. One thing is certain, that the trains have run well under excessive excursion demands and at a high rate of speed. It is safe to say that if the experiment of equipping the road proves entirely successful there will be other branches of the Consolidated road changed from steam to electricity in a very short time."

The New York *Journal of Commerce* says that President Clark, of the New York, New Haven & Hartford, has told a few of his intimate railroad acquaintances that by next year he expects to run through express trains from New York to Boston in four and one-half hours. To accomplish this $3,000,000 will be spent in raising six miles of track within the limits of Boston.

Beacon Lamp Company.

The Beacon Lamp Company has succeeded to the entire business of the Beacon Vacuum Pump and Electrical Company, of Boston, manufacturers of the well-known Beacon lamp, and under new management and a largely increased cash capital, will push the business on a larger scale than ever before. Mr. Jas. T. Haubay has been appointed general manager, and will spend a considerable portion of his time on the road, renewing old acquaintances and making new ones. Mr. Edward Cary will still have the entire supervision of the manufacturing end, and has also succeeded Mr. Henry Sachs (Kaliski) in the business management of the home office. Arrangements have been made for materially increasing the factory facilities, and the present output will be nearly doubled by the time the Fall trade opens, at which time higher prices are looked for.

Reduction of Aluminum by Electricity.

To the Editor of Electrical Review:

The Electrical Review is watched for as eagerly as my medical journals. It is fresh, bright and interesting. I would not be without it. Will you kindly answer: "How is aluminium or aluminum extracted by electricity—and what is the general character of the clay required?" A brief explanation of the process would be gratefully acknowledged.

Charles H. Merz, M. D.

Sandusky, Ohio, July 8, 1895.

Portable Electric Lighting Plants.

To the Editor of Electrical Review:

I saw quite an interesting article in my Review of May 1, 1895, on portable electric lighting, as used by "Buffalo Bill" for lighting his show. Whilst reading this article my mind was called back to a portable electric light car I used to see at Gettysburg, whilst attending our national encampments during the years 1887, 1888 and 1889. It was hauled there in the train and side-tracked near the depot, and would light in front of hotels and out on our camp grounds in the avenues and at headquarters. As near as I can now recall it was owned by the Cumberland Valley Railroad Company, was designed and operated by a Mr. Hull of said company. I had the pleasure of seeing this plant in operation on several occasions; it was compact and neat. If you desire to know more about it I suppose the Cumberland Valley Railroad Company could give you information.

Very truly yours,

Reader.

Philadelphia, June 15.

Electricity on Steam Railways.

To the Editor of Electrical Review:

After patiently waiting some two weeks for the electrical papers to make known the practical test of the trial of electric power on the cars of the Nantasket Beach Railway I was gratified to find the full details of same in your issue of July 3. While I had no doubts whatever as to the results of the trial, it is certainly interesting to get the earliest possible definite information concerning it. I should think that the results of the tests and trials as given, are enough to forcibly take away the breath entirely of the exultant advocates for the adoption of electrical motors and power for the branch and trunk line railroads. While there could not possibly be any doubt whatever as to the result of the trials, the eyes of skeptical capitalists and managers of our largest railroads have been patiently pointed toward the practical performance of the apparatus, etc., and the speed of 80 miles per hour, as attained, is but the forerunner of an expenditure of capital and experiments which will enable double the speed to be reached when necessary. I hope to soon see our largest locomotive works turn their entire attention to the manufacture of electrical apparatus for use on our trunk line railroads. The efforts of the electrical press will, undoubtedly, greatly assist in the development of same, and I am sure the Electrical Review will doubly do its share.

Sincerely,

H. Wellman,

Superintendent Ashland & Catlettsburg Street Railway Company.

Ashland, Ky., July 5.

University of Wisconsin's Scholarships.

For the purpose of encouraging and assisting the most meritorious students in engineering and the mechanical arts, the Regents of the University of Wisconsin have established the following scholarships:

Nine engineering scholarships which entitle the holders to the remission of their incidental fees for the period of two years will be annually thrown open to competition to all students who have been admitted to the freshman class and are registered in courses leading to degrees in the College of Engineering.

Seven additional competitive engineering scholarships which entitle the holders to the remission of their incidental fees for the period of two years will be annually awarded to students who are registered in courses leading to degrees in the College of Engineering, and who have successfully completed the required work of the first two years of their respective courses.

Particulars of the methods of awarding these scholarships may be obtained of President C. K. Adams, University of Wisconsin, Madison, Wis.

Mayor Pingree was motorman on July 8 on the first car which marked the start of the Detroit, Mich., Railway's new system, and at the same time the introduction of a three-cent fare, for which the Mayor has fought for several years.

Electric Light Plant of the Steamer "Bay State."

Accompanying this is an illustration showing the electric light plant on the new steamer "Bay State" of the Boston & Portland line recently installed by the Belknap Motor Company, of Portland, Maine. The dynamos are multipolar slow-speed machines of 400 lights capacity each, but either machine will carry the entire load, amounting to 549 lights. It has become a general practice to use duplicate plants for marine work, so in case an accident should happen to either engine or dynamo the duplicate machine can do the work. The dynamos were designed by Mr. W. H. Chapman, electrician for the company. This plant does great credit to the company and has secured further orders for the installation of two direct-coupled machines for the steamer "Portland," of the same line, also for the steamship "St. Croix," of the International Steamship Company, which is practically under the same board of management. The system of wiring includes eight main circuits controlled at the switchboard in the dynamo room which lead to 16 different distributing boxes containing switches located in different parts of the boat, each switch controlling six lights. These distributing boxes have glass fronts secured with lock and key and are under control of the steward of the boat. There are pilot lights on main and fore rigging and at the bow of the boat.

The fixtures are of the latest design with opalescent globes and shades. The dining saloon is fitted with ground glass globes which give this part of the boat a very cheery and pleasing effect. The freight deck lights are protected with guarded fixtures.

The boat at night presents a brilliant spectacle, being a veritable floating palace, and surpassing in all its appointments anything that can be found in eastern waters, the Sound lines alone excepted. The addition of this new boat has been the means of popularizing this line with the best class of the traveling public.

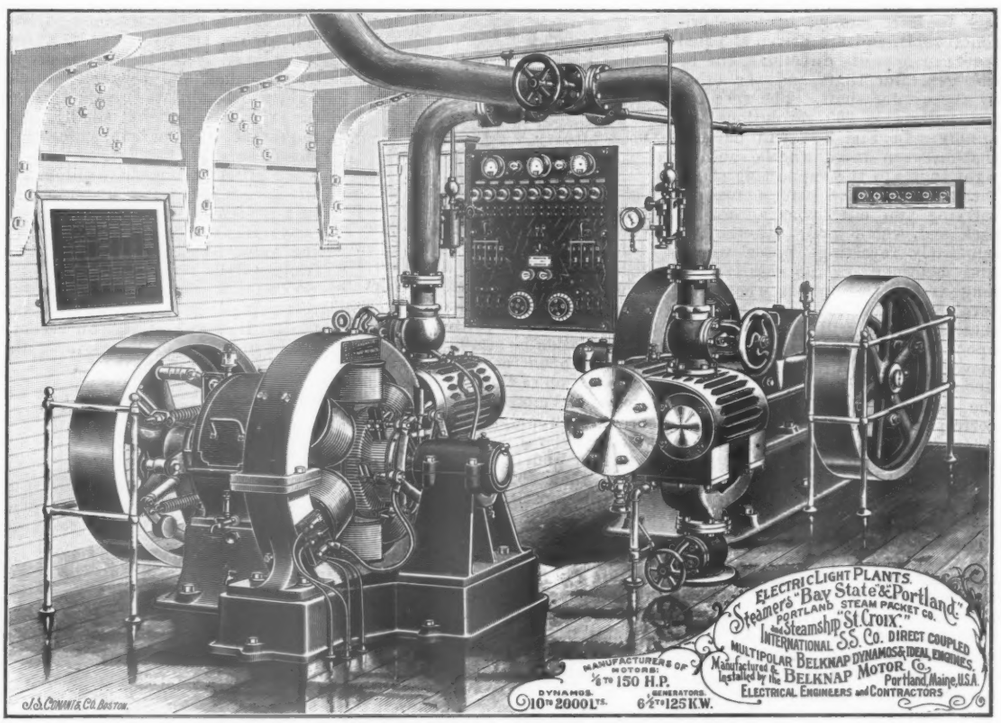
ELECTRIC LIGHT PLANTS
Steamers "Bay State" & "Portland."
PORTLAND STEAM PACKET CO.
Steamship "St. Croix."
INTERNATIONAL S.S. Co.
DIRECT COUPLED
MULTIPOLAR BELKNAP DYNAMOS & IDEAL ENGINES.
Manufactured & Installed by the BELKNAP MOTOR Co.
Portland, Maine, U.S.A.
ELECTRICAL ENGINEERS and CONTRACTORS
MANUFACTURERS OF MOTORS: ⅛ to 150 H.P.
DYNAMOS 10 to 2000 Lts.
GENERATORS ½ to 125 K.W.
J. S. Conant & Co. Boston.

Fig. 1.—Electric Lighting Plant on Steamer "Bay State."

Mather Receiver May Sell Property.

In the suit of Charles E. Perkins against the Mather Electric Company, of Manchester, Conn., Judge Thayer has passed an order to allow Charles M. Jarvis, the receiver of the company, to sell all the real and personal estate belonging to it. Before the property is sold, however, the receiver is directed to bring an application of sale to a judge of the Superior Court, who is to decide upon the terms of the sale, and five days' notice is to be given all persons who have appeared on record in the case, that they may be present at the hearing on the application.

KIND WORDS.

"OF GREAT IMPORTANCE."

To the Editor of Electrical Review:

As a practical electrician I find the Electrical Review of great importance to me. Enclosed is stamp for pamphlet on resuscitation of persons shocked by electricity.

B. C. S.

Nashville, Tenn., July 6.

A SOUTHERNER LIKES IT.

To the Editor of Electrical Review:

I like your paper.

F. F. Simpson, M. D.

Spartanburg, S. C., June 27.

Mr. W. H. Canfield and associates are installing a telephone exchange at Canaan, Conn., which will have connection with Norfolk and Winsted.

Electricity for Mining Purposes.

[From the Engineering and Mining Journal.]

The application of electricity to coal mining is growing so rapidly that it may be considered a question of a comparatively short time when it will supersede most other forms of power transmission for this purpose. It is only within recent years that marked progress has been made. Prior to 1887 but few plants had been installed, and not many of these were operating successfully; since then, however, great improvements have been made in every form of apparatus and machinery for this purpose.

The earlier uses of electricity were for signals between the underground workings and surface. Then for shot firing, operating electric locomotives, coal cutting machinery and supplying light. In the early installations danger was occasioned by the chance of sparks from wires, from poor insulation and other causes. These difficulties have, in greater part, been overcome in the latest types of machinery. It is now applied to pumping, hauling by both fixed motor and locomotive, to coal cutting and drilling. It is also used in signaling and, to some extent, in lighting. Its great advantage is its flexibility and readiness of application. Wires can be run from the main to drive anything, from a small hand drill to a heavy motor, and for temporary work no other form of power is so easy and inexpensive to transmit.

Among its other advantages is that it can be produced wherever a water power is available within reasonable distance of the mine and transmitted without much loss. An excellent example of this is the installation at Silverton, Colo. In this case a three-phase system is used and the current transmitted three miles from the electric plant to the mill and mine on the top of the mountain, where it costs $2 for delivering a prop and $8 per ton for coal. The estimated saving over the cost of coal hitherto employed is nearly $1,000 per month. Other and larger installations than this have been made for similar purposes and new ones are being started. Viewing the progress made in the past, it is fair to anticipate its enormous extension in the future. It will not be long before it takes the place of most other forms of transmission of power for such purposes and the mining and metallurgical fields must become, indeed have already become, among the most important markets for electrical appliances of all kinds.

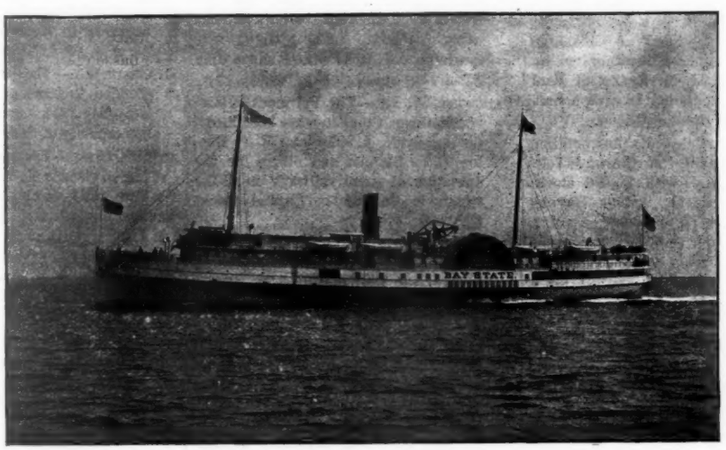

FIG. 2.—STEAMER "BAY STATE."

The Solar Electric Company.

Rumors have been current for some time regarding the consolidation of the interests of the Brooklyn Electric Manufacturing Company and the Solar Arc Lamp Company, which until recently has been denied by the officers of the companies. Papers recently filed with the Secretary of State, however, have proved that these rumors were not unfounded.

A syndicate has been formed which has secured the controlling interests of the two companies, and the consolidation has thus been effected.

The syndicate is composed of Hewitt Boice, Senator Jacob Rice, Andrew R. Baird and Samuel O'Connor, who, together with Geo. A. Mullen and St. Louis Wintner, form the officers of the company for the ensuing year, as follows: Hewitt Boice, president; Andrew R. Baird, vice-president; Geo. A. Mullen, secretary; St. Louis Wintner, general manager; and Samuel O'Connor, treasurer.

Mr. Boice is widely known as the head of the Blue Stone Association, and is identified with many of the railroad and banking interests of New York. Mr. Baird is one of the most prominent men of Brooklyn, and connected with many of its business institutions. Senator Rice holds extensive shipping interests in New York, and Mr. O'Connor is a well-known contractor.

The new company have secured fine office and showroom accommodations in the Vernon Building, 65-67 Duane street, with the shop occupying the rear building on Pearl street. The new company is starting out under the most favorable auspices, and with the prestige gained through the extensive interests of the officers of the company, together with the services of Messrs. Mullen and Wintner as active managers of the new concern, the company is in an unusually favorable position for doing an extensive and successful business.

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Manufacturers The Stirling Water Tube Safety Boiler,

PULLMAN BUILDING,

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PAUL MINNIS, General Manager,

Home Telephone Company, MOBILE, ALA.

N. B.—Applicants accepted must report September 1.

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PETTINGELL-ANDREWS CO., BOSTON, MASS.

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ST. LOUIS ELECT'L SUPPLY CO., ST. LOUIS, MO.

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CROCKER-WHEELER ELECTRIC COMPANY,

Manufacturers and Electrical Engineers.

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QUALITY UNEQUALED. FACTORY PRODUCTION TRIPLED.

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Monadnock Building, Chicago. - - - - Cleveland, Ohio.

ADVANCE INFORMATION.

VALUABLE INFORMATION FOR MANUFACTURERS AND DEALERS.

We publish below the earliest information obtainable relating to new electric railways, new electric light companies, new telephone companies and projected electric construction of all kinds. Every reader will find these columns of special interest, and manufacturers and supply houses will receive many valuable suggestions looking to new business by carefully watching this department in the ELECTRICAL REVIEW from week to week.

Increase of Capital Stock.

PITTSBURGH, PA.—The Electric Messenger Company has increased its capital to $500,000, and will extend its system as rapidly as possible.

GOUVERNEUR, N. Y.—Application of the Ogdensburg street railway to use the electric trolley as a motive power has been granted, and to increase its capital from $75,000 to $150,000.

LITTLE ROCK, ARK.—The Little Rock Telephone Company has increased its capital stock to $100,000.

New Manufacturing Companies.

CHARLEROI, PA.—The Union Electric Company has been incorporated with a capital stock of $1,000.

CHICAGO, ILL.—Electric Shower Bath Company has been incorporated by Levy Beemer, Michael J. Lyons and William A. Cunningham. Capital stock, $30,000.

REED CITY, MICH.—Reed City Electrical Company has been incorporated with a capital stock of $10,000.

DES MOINES, IA.—The Hall Electric Power and Transportation Company filed articles of incorporation to erect, manufacture, operate, sell, lease and deal in electrical appliances, gas machines, engines of all kinds and all other machines or appliances. Incorporators are Robert H. Laird, Truman M. Hall, Loftus E. Dancey.

DES MOINES, IA.—The Laird Electrical Power and Transportation Company has been incorporated. The capital stock is $110,000. Officers: Robert H. Laird, president; Truman M. Hall, vice-president; Robert H. Laird, treasurer, and Loftus E. Dancey, secretary.

New Telephone and Telegraph Companies.

MADISON, WIS.—Douglas County Telephone Company has been incorporated; capital, $30,000. Incorporators, P. G. Stratton and Russell Baxter.

SALISBURY, MD.—A franchise has been granted to Mr. W. H. Jackson to erect a telephone from this place to his farm on the Quantico road. A franchise was also granted Messrs. Sampson, Truit, Major Humphreys and Mr. S. E. Gordy to erect a line to connect their farm with the town line. There is talk also of running a line out to Nutter's, so that all sections of the county will be connected with Salisbury.

WORCESTER, MASS.—The contract for constructing the new building of the New England Telephone and Telegraph Company has been awarded to John Kelley.

ELWOOD, IND.—J. H. Overshimer has purchased the Pana telephone exchange; consideration, $3,000.

COUNCIL BLUFFS, IA.—The Iowa Harrison Telephone and Construction Company has been formed in this city, with S. B. Wadsworth, S. L. Etnyre, C. E. H. Campbell, A. W. Johnson and C. M. Hard as incorporators. It has $100,000 capital stock.

FRANKLIN FALLS, N. H.—A direct telephone line is to be put in between here and Tilton and free tolls allowed between the two places.

SCHWENKSVILLE, PA.—A movement is on foot to have a telephone line between this place and Red Hill.

THOMASVILLE, GA.—There is a movement to build a telephone line from this place to Tallahassee.

RICHMOND, VA.—The Southern Electric Construction Company has been incorporated with J. M. Collingworth, president; C. F. Wingo, vice-president; G. S. Maxwell, secretary and treasurer, for the purpose of constructing and equipping telephone plants and exchanges, electric light plants, and do a general electric business. Capital stock, $25,000.

SAN ANTONIO, TEX.—The West Brokerage Company has been incorporated by J. R. Ransom, J. M. Ryan and Paul Richards, to construct telegraph line, with a capital stock of $10,000.

CONWAY, IA.—Articles of incorporation have been filed by the Conway Telephone Company with $5,000 stock. Officers: President, Arthur Haynie; secretary, Miles H. Simmons.

LE MARS, IA.—The Cothreell Telephone Company has been granted a franchise. Allen Bros. have also applied for a telephone franchise.

Business Troubles.

HILLSBORO, ILL.—Godfrey H. Atkins was appointed receiver of the electric light plant at this place, in the suit of the General Electric Company against George W. Graham, et al., by Judge Allen.

New Electric Railways.

CHICAGO, ILL.—The Inter-Ocean Electric Railway Company has been incorporated by Henry E. Beasle and others, with a capital stock of $2,000,000.

FREEPORT, ILL.—The South Freeport & Cedarville Electric Railway has been incorporated by A. Bergman, Henry Lichtenberger and A. Baumgarthner, with a capital stock of $100,000.

PONTIAC, ILL.—The Pontiac Transit Company has been incorporated by C. C. Strawn, I. F. Fink and L. S. Strawn to construct a street railway. Capital stock, $100,000.

SCHUYLERVILLE, N. Y.—Greenwich & Schuylerville Electric Railroad Company, incorporated by Watson M. Sprague, Robert Hamilton, of Greenwich, Martin Schenck, Reeves Smith, of Troy, James E. Kelley, of Schuylerville, and A. M. Crandell, of Middle Falls, to construct a surface road six miles in length, from Greenwich to Schuylerville.

SPOKANE, WASH.—The Spokane Terminal Railway Company has been incorporated by S. Openheimer, W. R. Newport, A. B. Hopper and H. A. W. Binket, to build and operate a railroad; capital stock, $1,000,000.

DETROIT, MICH.—A franchise has been granted to William Livingston, Jr., George H. Russell and Thomas H. Baskerville to construct and operate a street railway either by horse or electric power.

MCARTHUR, OHIO.—The bonds of the electric railway to run from this place through Wellston to Jackson have passed into the hands of C. P. Huntington, of the Chesapeake & Ohio. The $2,000,000 will be paid in monthly payments of $50,000 each.

WARREN, PA.—The Franklin electric street railway has passed into the possession and control of a local syndicate.

PITTSBURGH, PA.—The property and franchise of the McKeesport and Reynoldton passenger railway have been purchased by the Second Avenue Traction Company for $375,000.

JACKSONVILLE, FLA.—A company is being organized to operate an electric line of cars between this place and Tampa, via Sanford.

WADSWORTH, OHIO—The Wadsworth Electric Railway Company has been incorporated by W. A. Ault, M. C. Lytle, O. B. Dibble, J. S. Oberholtzer, F. C. Lee and F. B. McCauley.

SYRACUSE, N. Y.—W. B. Cogswells, C. B. Tracy, G. Higgins are interested in the erection of a new electric railway between Syracuse and Manlius. Capital stock, $250,000.

ALBANY, N. Y.—Albany & Suburban Railway Company has been incorporated by R. F. Barnes, John S. Burke, George T. Cunningham, George B. Moore, Arthur Hilton, John Leggett, Albert J. Barnes and others to construct a road to connect Greenwick, Castleton and Bath-on-the-Hudson with Albany. Capital stock, $200,000.

FAIRMONT, W. VA.—The Fairmont Suburban Railway Company has been incorporated by N. A. Clayton, W. T. Horton, C. L. Skinner and others for the operation of street railways on all the streets in Fairmont. Capital stock, $200,000.

ALTON, ILL.—Alton Railway and Illuminating Company has been incorporated by James F. Porter, Charles W. Illner, Henry R. Phinney. Capital stock, $250,000.

CHICAGO, ILL.—Chicago Western Electric Street Railway Company has been incorporated by Henry T. Beam, Maier Rosenthal and Harlan W. Cooley. Capital stock, $5,000,000.

BALTIMORE, MD.—The Baltimore, Columbia & Maryland Railroad Company contemplate building two electric power houses.

KINSMAN, OHIO—The North Trumbelle Rapid Transit Company has been incorporated with a capital stock of $10,000.

PHILADELPHIA, PA.—The Electric Traction Company contemplates building an extension of its line from Fifth street and Rising Sun lane to Fox Chase.

PHILADELPHIA, PA.—Little Saw Mill Run Street Railway Company has been incorporated to run from Pittsburgh to Castle Shannon. Capital, $36,000.

HARRISBURG, PA.—The Pennsylvania Traction Company, of Lancaster, Pa., has applied for a charter for the Philadelphia, Lancaster & Harrisburg Railroad Company; capital, $6,000,000.

POTTVILLE, N. Y.—This place is to be connected with Olean by a trolley line.

HOPKINTON, MASS.—The contemplated electric road between this place, Woodville and Westboro is now an assured fact, the stock necessary to build and equip the same amounting to $60,000, being all subscribed.

ROCKDALE, TEX.—J. R. Rowland is interested in the proposed electric railway, for which several electric power plants will probably be built.

ALTON, ILL.—The Alton Electric Street Railway Company purchased the Alton Improvement Association's motor line and the Alton and Upper Alton Horse Railway for $100,000. The new owners will assume control Saturday.

GALLIPOLIS, OHIO.—Colonel John L. Vance, of this city, has bought the Gallipolis Street Railroad at sheriff's sale, paying $17,275. The road was appraised at $11,500 and was, it is said, $50,000 in debt.

BOSTON, MASS.—It is reported that the Quincy & Boston Street Railway Company is to buy the Braintree, Holbrook & Randolph Street Railway.

ROME, GA.—J. King, who is interested in the Rome Electric Light and Street Railway Company, has been in Augusta recently, looking at the machinery that has been put up by the General Electric Company. He intimated that he would probably purchase a 100-arc light machine of the Brush type to be used in connection with the railway plant at Rome.

Electric Light and Power.

WICHITA FALLS, TEX.—An electric light plant is being equipped by Mr. Varley, of Whitesboro. Machinery is now being placed in position.

TOLEDO, OHIO.—Western Electric Light and Power Company reported as having recorded real estate chattel mortgage for $200,000.

CAMPELLO, MASS.—The factory of George E. Keith is to have an electric lighting plant of its own. It will generate 1,000 lights.

FREMONT, NEB.—The contract for putting in an electric light plant has been awarded to Bigelow & Company, of Lincoln, for $17,100.

ST. CLAIR, PA.—The citizens of this place decided to increase the borough's indebtedness $9,000 in order to enlarge the capacity of their electric light plant.

ATHENS, OHIO.—The contract for constructing an electric light plant at the State Hospital here has been awarded to the Franklin Electric Company, of Kansas City.

CLINTON, PA.—The contract for the construction of the new electric plant has been awarded to W. A. Apgar, of this place.

ABERDEEN, MISS.—The Mayor can give information concerning the erection of new waterworks and re-establishment of the electric light plant.

SCOTLAND NECK, N. C.—A. McDowell can give information concerning the erection of an electric light plant.

HAWKINSVILLE, GEORGIA.—The Mayor can give information concerning the erection of a new electric light and waterworks.

PORTLAND, ME.—The Bacon Light Company has been incorporated by Isaac Weils, president, L. C. Whicher, treasurer, to manufacture machinery for vacuum pumps and incandescent lamps. Capital stock, $500,000.

CHICAGO, ILL.—Pocatello Electric Light and Power Company has been incorporated. Capital stock, $150,000. Incorporators: Charles W. Spalding, Daniel Swichert and Francis W. Smith.

COLUMBUS, OHIO.—The Defiance Light and Fuel Company has been incorporated by Walter R. Faber, James W. R. Clews, Wm. R. Morrison, Oscar T. Martin and John A. Showalter. The capital is $30,000.

ST. JOHNS, MICH.—This village will vote on the proposition to bond the village for $35,000 to purchase an electric light plant.

COLUMBIA, GA.—The latest industrial improvement to be undertaken at this place is the building of an immense electric power plant at the foot of the canal.

MANHEIM, PA.—A charter has been granted to the Manheim Light, Heat and Power Company; capital stock, $20,000. The directors are Vance C. McCormick, Harry B. McCormick, Harrisburg; F. E. Bailey, Philadelphia; L. U. Bailey, Dillsburg; Robert A. Carl, Harrisburg. The plant will be built at once by F. E. Bailey & Company, of Philadelphia, and will consist of a combination steam and water power plant to drive the generators. The streets will be lit up and lights and power will be furnished to Manheim and vicinity.

CONCORD, N. H.—The contract to light the town with electricity has been awarded to Pillsbury Brothers.

MARYVILLE, MO.—The electric light plant is to be enlarged.

BARTON, VT.—It is estimated that $50,000 will be expended in the erection of the electric light plant.

WILLMETTE, ILL.—The Willmette Electric Light and Power Company; capital stock, $10,000. To manufacture electricity. Incorporators, John S. Moyer, Edwin Webb.